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Division of
Hydrographic Construction

SUPPLEMENT

1889

RELATING TO THE

BAY OF BENGAL PILOT,

1887.

(Corrected to 31st December, 1889.)

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

LONDON:

PRINTED FOR THE HYDROGRAPHIC OFFICE, ADMIRALTY,
By DARLING & SON, LTD., 1-3, GREAT ST. THOMAS APOSTLE, E.C.,

AND SOLD BY

J. D. POTTER, AGENT FOR THE SALE OF ADMIRALTY CHARTS,
31, POULTRY, AND 11, KING STREET, TOWER HILL.

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The following information, in correction of the Bay of Bengal Pilot, 1887, is derived from the surveys and remarks by Captain P. Aldrich, H.M.S. *Egeria*, 1887, and Commander A. Carpenter, R.N., Marine Survey of India, 1887-8 ; also from notices published by the Government of India, 1887-9.

This Supplement cancels all Notices to Mariners relating to the Bay of Bengal Pilot, 1887, issued since the date of its publication up to and including No. 449 of 1889.

*Hydrographic Office, Admiralty, London,
31st December, 1889.*

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A list corrected to 31st December, 1889, of additions and alterations to lights received after the publication of Bay of Bengal Pilot in the year 1887 will be found at the end of this Supplement.

§ O 10975.



[The existence of this Supplement is to be entered on the opening page of the Bay of Bengal Pilot. The information contained in it is to be carefully considered.]

SUPPLEMENT

1889

RELATING TO

BAY OF BENGAL PILOT, 1887.

The several paragraphs follow as much as possible the order of the paging of the Bay of Bengal pilot, 1887. The pages referred to are herein given in the margin.

All Bearings are Magnetic.—Variation in 1889.

CHAPTER I.

GULF of MARTABAN—Tidal Streams.—By observations pp. 23, 299.
taken on board H.M. Indian surveying vessel *Investigator*, in January, 1887. In the gulf of Martaban, when on a line between China Bakir lighthouse and Kalegouk island, coast of Tenasserim, the streams were always found to be setting to or from Sittang river; and there was no circular set. At springs there was a slack water of half an hour corresponding to the time of high and low water at Amherst. The maximum rate of the flood and ebb was $3\frac{3}{4}$ knots an hour. This rate is probably greater during the wet season.*

Behar bank.—Resulting from an examination made by H.M. p. 32.
surveying vessel *Flying Fish*, in the year 1887. Behar bank, formerly reported to have a depth of 30 fathoms, has been expunged from the Admiralty charts.†

Omission.—Line 11. Following “For directions &c. &c.” add p. 30.
“pages 317 and 326.”

Colombo.—Repairs to large machinery are undertaken by the p. 35.
Colombo iron works, whose plant is exceptionally good. Two steam tubes for vessels of 3,500 and 4,000 tons have recently been bored, and a cylinder 60 inches in diameter bored. There is a crane on the government wharf capable of lifting a weight of 15 tons; the depth alongside this wharf at low water is 4 feet.

* See Admiralty chart, Bay of Bengal, Sheet 3, No. 823.

† Originally published in Notice to Mariners, No. 114 of 1887. See Admiralty chart, Bay of Bengal, No. 70.

CHAPTER II.

CEYLON.

Variation 1° Easterly.

p. 39. **BARBERYN ISLAND.**—Information has recently been received of the existence of the following sunken rocks westward of Barberyn island:—

(1) A rock, Mana Golla, with a depth of $3\frac{1}{2}$ fathoms, is situated with Barberyn island bearing S. 68° E. distant three quarters of a mile.

(2) Two rocks, Goda Golla, and Rama Cate, with depths of 5 and 4 fathoms on them respectively, are situated between Mana Golla rock and Barberyn island.*

A lighthouse is in course of construction on Barberyn island.

Fanny rock.—According to an examination made by Lieutenant Channer of the Marine Survey of India, there is a depth of 4 fathoms in the position of Fanny rock.

p. 45. **POINT de GALLE approach.**—Too much reliance must not be placed on the outer buoys of Point de Galle, as they are liable to break adrift.†

p. 47. **Para rock.**—The buoy marking this rock has been withdrawn, and will not be replaced.

p. 46. **Point de Galle harbour.**—The existence of a sunken rock lying about three-quarters of a cable northward of Para rock, at the entrance to that harbour, has recently been reported. This rock (Inner Para rock), with a depth of $4\frac{1}{2}$ fathoms at low water spring tides, lies with the following marks and bearings: the white mark in line with the northern lower edge of Watering point, E. by N. $\frac{1}{4}$ N; the flag staff on Neptune bastion just touching southern side of the lighthouse, N.W.‡

* Originally published in Notice to Mariners, No. 267 of 1888. See Admiralty charts:—Cape Comorin to Cocanada, No. 828; Ceylon, south coast, No. 813.

† See Admiralty chart, Point de Galle approaches, No. 819.

‡ Originally published in Notice to Mariners, No. 387 of 1888. See Admiralty charts, Point de Galle harbour, No. 820.

CEYLON—SOUTH-EAST COAST.*—The coast offers but few conspicuous objects. The general character of the coast is low and monotonous; from Kumbukkan Aru to Komarie, jungle is prevalent; thence to Vendelus bay, cocoa-nut trees abound; while beyond the latter to Foul point nothing but jungle is again to be seen.†

The coast between Kumbukkan Aru and Komarie, 30 miles distant, trends in a general N. by E. $\frac{1}{2}$ E. direction, and is broken only by a few slight indentations. The shore line is nearly all sand backed by jungle, which extends over low flat wooded ground, joined by isolated hills, which are at a considerable distance from the sea, and which are of much use in determining a vessel's position.

Landmarks.—Dematagala (lat. $6^{\circ} 30' 38''$ N., long. $81^{\circ} 31' 31''$ E.); this hill is situated about 10 miles from the coast, west (nearly) from the Kambukkan Aru. When bearing to the north-west it is seen to have two peaks, and then answers the description of Nipple hill (see p. 63 Bengal pilot), the name by which it was formerly known. When bearing to the southward there is nothing remarkable about the hill except that it is higher than the adjacent hills.

Mandagala (lat. $6^{\circ} 31' 8''$ N., long. $81^{\circ} 37' 16''$ E.) previously known as Chimney hill (see page 63), is conspicuous, its summit having a precipice of light-coloured rock facing northward. When this hill, which is about 5 miles from the coast, bears to the N.W., the summit of the precipice forming the chimney appears clear of the summit.

Chimney hill or Pagoda peak (lat. $6^{\circ} 39' 12''$ N., long. $81^{\circ} 29' 36''$ E.), about 11 miles to the north-west of Mandagala, is a remarkable hill, its base appearing as a truncated cone surmounted by a perpendicular rock much like a chimney—hence its name. Isolated and conspicuous, it may be kept in view by a vessel passing along shore at 4 miles distant, the hill showing up above the low intervening land.

Yakala is a small village situated a short distance from the sea, and not visible from the offing. The locality of the village may be known by a little grassy hillock or mound, which stands on the beach about $2\frac{1}{2}$ miles north of Kambukkan Aru river.

At 5 miles northward of Yakala commences a rugged rise, 372 feet high, named Rugged ridge, and easily distinguished. Thence to Panawa point, 8 miles distant, the only remarkable object is a solitary sand hill $3\frac{1}{2}$ miles southward of the said point.

* These remarks are adapted to a survey of the coast between Little Basses and Foul point, Trincomali, made by Captain Aldrich, H.M. Surveying Vessel *Egeria*, March to August 1887. They supersede pages 68 to 71 (inclusive) Bay of Bengal Pilot.

† See Admiralty chart, Ceylon south coast, No. 813.

Between Yakala and Rugged ridge the coast is foul to a distance of three quarters of a mile.

Panawa point, a sandy ridge covered with jungle, terminates in a scrub-covered rocky point 85 feet high. Southward of the point there is a great deal of bare sand, which when seen from the northward and southward makes as a flat-topped islet. Bolt islet, nearly 3 miles northward of Panawa point, is a rounded and scrub-covered rock 92 feet high.

Arugam bay.—There is good landing in the south corner of this bay. During the period between February and May coasting vessels arrive for the purpose of shipping timber. The entrance of a river is in this bay, but during the time the survey was in progress was found to be completely barred by sand.

Nilagalahela, or Saddlehill, lat. $6^{\circ} 50' 44''$ N., long. $81^{\circ} 42' 12''$ E., 655 feet high, stands by itself 8 miles from the coast, and has two summits, the north-eastern one being a little higher than the other. Nilagalahela, when seen on a westerly bearing, appears as a single-peak hill, steep on the southern side. Darker in colour than the surrounding country, and being the highest hill within a radius of some miles, it is useful as a landmark.

Sangama Kanda.—About Sangama Kanda the land becomes higher, and consists of scrub-covered hills between 200 and 280 feet high, with no well-defined summits. Close southward of Sangama Kanda there is a long sand patch on the coast line. This, with the higher land alluded to, marks the locality of Komarie and of Komarie ridge. From hereabouts the peak of Wadinagala or Falsehood, Kumburahela, and Westminster Abbey, are very conspicuous. Friar's hood, to the northward, shows up well, while the Pambuthai range extends a good part of the way between the Hood and the hills about Wadinagala.

Komarie point, or Sangama Kanda, is a wooded curve a short distance north-eastward of Komarie village, and is not easily distinguished from the offing, while the village cannot be seen at all.

Soundings.—The soundings off this portion of the coast are for the most part regular, and increase gradually as the shore is left, the chief exception being the ground between Arugam bay and Sangama Kanda, and the shoals now to be mentioned.

Komarie ridge.—This dangerous shoal, composed of sand and coral, and having $2\frac{1}{2}$ fathoms least water, is about $3\frac{1}{2}$ miles long, and

extends nearly parallel with the coast. The south extreme of the shoal is in lat. $6^{\circ} 59' N.$, and 8 cables from the shore; the north extreme in lat. $7^{\circ} 2\frac{1}{2}' N.$ is nearly $1\frac{1}{2}$ miles from the shore.*

Egeria Patch.—Seaward of Komarie ridge and to a distance of p. 69. 4 miles from the shore the bottom is uneven. Egeria patch, with a depth of 7 fathoms, lies nearly 4 miles from the shore with Kumburahela bearing N. $71^{\circ} W.$

From the very uneven nature of the bottom breakers may be caused by winds and currents. The currents run with considerable strength and are irregular, but they were found to set along the shore northward or southward, but not towards the shore.†

The Coast from Komarie has a general northerly direction as far as Batticaloa. The land near the sea is low and flat, and in many places cultivated with cocoanut. At 20 to 30 miles inland are several conspicuous hills. Kumburahela (Aganis peak), in lat. $7^{\circ} 3' 7'' N.$, long. $81^{\circ} 40' 2'' E.$, is 1,134 feet high, sugar-loaf in form, and stands by itself some 12 miles from the sea.

Westminster Abbey, in lat. $7^{\circ} 2' 21'' N.$, long. $81^{\circ} 32' 48'' E.$, is a remarkable hill. The so-called tower is at the north-west end, 1,830 feet above the sea. The hill is seen to the greatest advantage from a position northward of Komarie, though it is readily distinguished from the southward also.

Wadinagala (or False Hood) is conspicuous on all bearings. The summit is precipitous or nearly so on all bearings, and forms a sharp peak 2,413 feet high. In clear weather the higher and more distant hills are visible. Of these are Maragalkanda, a long rounded hill, and Namanukuli; the latter, 6,680 feet high, rises to a sharp peak, and somewhat resembles Wadinagala. Sharp hill, 6 miles from the coast, Thomson hill, wooded, and Bennington hill, wooded and wedge-shaped, are noticeable.

Friar's Hood, in lat. $7^{\circ} 26' 49'' N.$, long. $81^{\circ} 30' 29'' E.$, 2140 feet high, is well named, and readily distinguished in clear weather at long distances. There are other hills round it, but the peak of the Hood is unmistakable.

Soundings.—The soundings between Komarie and Batticaloa are regular, with the exception of a few rocky patches within a mile

* The shoal of 6 feet water mentioned at page 68 *foot note* is probably a part of Komarie ridge; as also the rock on which the S.S. *Macgregor* struck in 1881, see page 69.

† Granville rock, said to be situated with Komari point bearing N. by W. $\frac{1}{4} W.$ distant 6 miles, was not found during the survey of 1887.

distant from the shore. Outside, beyond this distance, the lead is of great use.*

p. 71. **Alphée shoal**, having a depth of $3\frac{1}{4}$ fathoms, coral, is about $1\frac{3}{4}$ miles from the nearest shore. Its extent within a depth of 5 fathoms is about $1\frac{1}{2}$ miles north and south and three-quarters of a mile east and west. The shoal head lies in lat. $7^{\circ} 26' N.$, and Friar's Hood bears west of Wadinagala S.W. $\frac{1}{4} W.$

p. 69. **BATTICALOA**, the principal town in the eastern province of Ceylon, is situated at 3 miles from the northern entrance of Batticaloa lagoon. The bar, which has a depth of 6 feet at low water, extends across the entrance. During the S.W. monsoon—March to September—there is not much difficulty in crossing the bar. But the N.E. monsoon sends in a heavy sea, and gales from the N.E. are not unfrequent; the channel shifts after each gale, so that communication between land and sea is seldom possible between October and March.†

Pilots.—The natives at the signal station are all acquainted with the bar, and the usual pilot signal will bring them off. A small government coasting steamer calls here fortnightly, but seldom communicates during the north-east monsoon.

Signal Station.—On the west side of the entrance is a signal station with flagstaff, also the Custom-house and a few other houses. The flagstaff is 47 feet high and a good mark for recognising the locality, as it is visible a considerable distance. Vessels may communicate by the International code of signals.

On the beach at three-quarters of a miles to the north-westward is a white obelisk 25 feet high, conspicuous in the forenoon and nearly always seen quite distinctly before a vessel reaches dangerous ground.

Communication.—Telephonic communication extends between the signal station and the town, thence by telegraph with Colombo. There is a good road between the bar and the town, and communication also by boat. A government agent resides at Batticaloa.

LIGHT.—From the signal staff is exhibited, at an elevation of 47 feet above the sea, a *fixed white* light, visible in clear weather from a distance of 8 miles.

* See Admiralty chart, Ceylon east coast, No. 2031.

† See Admiralty plan of Batticaloa roads on Admiralty chart, No. 2,031; scale, $m = 4$ inches.

Caution.—In attempting to sight this light at night, the lead should be constantly attended to, and the water should not be shoaled to less than 10 fathoms until the light is sighted.

Anchorage.—The roadstead affords good anchorage in the S.W. monsoon. Foul ground extends some distance north-eastward of the signal staff, and in approaching from the southward the soundings should not be less than 10 fathoms until the obelisk bears S.W. $\frac{1}{4}$ W.

Beacon rock, on which there is a black buoy during the S.W. monsoon, has $1\frac{1}{2}$ fathoms water and lies N.E. by E. $\frac{1}{4}$ E. $1\frac{1}{2}$ miles from the flagstaff.

Brennus shoal, having a depth of $1\frac{3}{4}$ fathoms, lies N.E. $\frac{1}{2}$ E. a mile from the signal staff. There is foul ground within a distance of 2 cables east and west of this position, and all the ground between Brennus shoal and the shore is foul.

A coral head with 3 fathoms lies N.E. by N. $1\frac{1}{4}$ miles (nearly) from the signal staff and N.E. by E. $\frac{1}{2}$ E. $1\frac{1}{6}$ miles from the obelisk. The shoal is not marked.

Surveyor rock consists of two patches with $3\frac{1}{2}$ fathoms on them. The north-eastern patch lies N.E. $\frac{1}{2}$ N. 7 cables from the obelisk and N. $\frac{3}{4}$ W. 9 cables from the flagstaff, and is marked by a red buoy during the S.W. monsoon.

The south-western patch (named Khandalla) lies N.E. $\frac{1}{2}$ N. 6 cables from the obelisk.

Directions.—A vessel may enter the roadstead with 4 fathoms least water by steering with the obelisk bearing S.W. $\frac{1}{4}$ W. until the signal staff bears S. by E., then anchor in $6\frac{1}{2}$ fathoms. This is a convenient berth for communication with the shore, and is 2 cables clear of Surveyor rock.

The best route in for a large ship is with the obelisk bearing S. by W., and the anchor should be let go in $7\frac{1}{2}$ fathoms when the signal staff bears S.S.E. $\frac{1}{2}$ E.

Local knowledge is essential when crossing the bar if there be any sea.

The coast from the entrance to Batticaloa lagoon trends p. 71. N.W. by N. to Vendelus point, which is foul to a distance of a quarter of a mile. Nearly midway is Puna Kuda point, on the north side of which is the bight named Puna Kuda. Kal Kuda or Rocky bay, on the south side of Vendelus point, is so called from a number of sunken rocks. It is considered possible that good shelter

may be obtained here during the N.E. monsoon for small vessels in 2 to 3 fathoms close in shore.

Northward of Vendelus point is Vendelus bay, or as it is named by the natives Passi-Kuda (Mosay bay). The Vala Chenai river falls into this bay; shoal and foul ground extend a mile seaward of its mouth, and skirts also the shores of the bay.

Clarke point, nearly 5 miles to the northward of Vendelus point, is low and surrounded by rocks and foul ground. Off the north extreme is Elephant rock, 60 feet high, light in colour, and visible from a distance of 12 miles.

Soundings.—Between Batticaloa and Clarke point the soundings are regular beyond the 10-fathoms line, but at night, or in thick weather, a vessel should not shoal less than 20 fathoms: this depth will be found at a distance of not less than 2 miles from the several points. But it should be observed that off Puna Kuda point there is a deep and narrow cleft in the bottom, where the 100-fathoms line of soundings is only 2 miles from the shore.

From Clarke point to Foul point the soundings outside the 10 fathoms line are regular, and the shore may be approached to that depth. On the edge of the bank of soundings the depths increase suddenly; heavy overfalls occasionally occur in the finest weather.

The offshore soundings now given are of such a nature as to render navigation safe even in thick weather, if the lead be attended to, and the ship not allowed to come into less than 20 fathoms of water.

The disasters which have taken place from time to time on this coast, supposed to have been on dangers situated some miles from the shore, were probably due to difficulties in fixing the true position; difficulties caused by the absence of soundings, and also by the fact that some of the mountain peaks in the interior, used as landmarks, were not in their true positions on the former charts; these inaccuracies now remedied from the trigonometrical survey of Ceylon, carried out by the Surveyor-General of that Colony.

From Clarke point to Foul point lighthouse the coast trends nearly N. by W. throughout; it is low, and the hills inland are few and unimportant. There are, however, several conspicuous rocks above water which lie at short distances from the land.

Cheltivo is a small wooded islet about 30 feet high, half a mile from the coast, and 9 miles northward of Elephant rock. Panditivu point is sharp, rocky, and has a small rock above water close to it. Virgil rocks, about 2 miles northward of Kadeawella point, are about a mile distant from the shore. These are two sunken rocks

and one three feet above water. Tree rock, about 4 cables from the shore and 5 miles northward of Kadeawella, is so named from having a tree, and is thus easily distinguished.

Alligator rock, 3 feet high, is rather more than $1\frac{1}{2}$ miles from the shore, with a sunken rock close to its north-east side. This danger may be known by a conspicuous rock (Ship rock) 62 feet high, which lies nearly a mile inshore. There is also a conspicuous patch of rock on the coast line.

There are numerous detached rocky islets off Illantatturai, one of which, 60 feet high, has trees growing and is therefore remarkable. So is White rock (3 miles further north) in the forenoon: it stands on the beach and is 25 feet high. Heming rock is a group which extends to the north-eastward of White rock for $1\frac{1}{2}$ miles; the highest is 20 feet high: the north-eastern one, 7 feet high, is a mile from the shore.

Landmarks.—Tower hill has a conspicuous rock at the summit, which has the appearance of a tower; the hill is otherwise hog-backed. Baron's cap, formerly known as Sugar-loaf, is 691 feet high, and in lat. $7^{\circ} 50' 22''$ N., long. $81^{\circ} 23' 35''$ E. From the eastward and southward it has the appearance of a sugar-loaf, and when seen clear of other hills is a conspicuous object, particularly so on a W. by N. bearing. Seen on a south-west bearing it has a much broader top, and in appearance merges into the hills to the southward.

Krimechiodai Malai is 185 feet high, and only seen when bearing between W.N.W. and W.S.W., when it appears as a low wedge-shaped hill sloping from the northward up to a sharp little peak, which has a steep fall to the southward.

Kunchan Kallu, 410 feet high, formerly known as the "Small Quoin," is, when seen on a north-westerly bearing, wedge-shaped, with a moderately steep fall at the southern end. On a south-westerly bearing it appears as a low hill without any well-defined summit.

Small Quoin, lat. $8^{\circ} 2' N.$, long. $81^{\circ} 18' 20'' E.$, 518 feet high, was formerly shown on the Admiralty charts as Baron's cap. When seen from the S.E. it slopes moderately on either side to a rounded and small summit.

Quoin, a large wedge-shaped hill much further inland, becomes very useful as a landmark and is well named.

Winds and currents.—At pages 378 to 390, Bay of Bengal Pilot, are given monthly statements of winds and currents as experienced by Mr. Thomas Robson, Commander of the Colonial Government Steamer *Serendib*. Captain Aldrich, of H.M. surveying

vessel *Egeria*, states that during the time—March to August 1887—the *Egeria* was employed in surveying the east coast of Ceylon between Little Basses and Trincomali these statements were found to be generally correct. The weather was very fine with but few exceptions, the *Egeria* anchoring off the coast every night. No hard gales were experienced.

Currents.—The currents mentioned in Mr. Robson's statement are such as are experienced in the offing. Nearer the coast, where the *Egeria* was anchored, hourly observations for direction and velocity of the inshore currents were made, but no rule could be deduced therefrom. The currents often changed from north to south and back again in a short time, without any apparent reason. On no occasion, however, were they found to set either on to, or off the coast. In running a line of soundings out from the land it was often observed that the northerly and southerly currents set side by side, the vessel passing from one to the other more than once on the same line, that is, at between 3 and 10 miles from the shore.

GLOSSARY.

English.	Singalhesse.	Tamil.
Mountain hill	Kanda-hela gala	Malaí.
Rock	Gala-gal	Kallú kal.
Bay	Kudawá	Kudá.
Harbour	Waráya	Turai muka.
Custom house	Riguwa	Paku, or Aluppanti.
Provisions	Ahara	Jin Chàmàn.
Doctor	-	Dakuttai.
Boat	Oruwa	Toni Vallam Kattai.
Cargo	Petawili	Chàmàn.
River	Ganga, or Oya	Aru, or Ár.
Mouth of river	Modara, Tota, Taru	Mukattuvaram.
Surf	Rela, or Ratè	Alai, or Kaddal.
Seashore	Werala	Kadat Karai.
Tree	Gaha, Ruka	Maram.
Flagstaff	Kodi gaha	Kodi maram.
House	Geya, gè	Vèdu.
Hut	Pela	Kudil.
Point	Indawa	Munai.
Jungle	Kèlè	Kàdù.
Wind	Hulanga	Kattu.
North wind	Uturu hulan.	
South wind	Dakunu hulan.	
Sea breeze	Mutu hulan.	
Land wind	Goda hulan.	
Rocky point	-	Kál Mūnai.
Rocky bay	-	Kàl Kūda.

TRINCOMALÍ HARBOUR.—A buoy has been temporarily placed to mark the eastern boundary of the submarine mine field between Great Sober island and Clappenberg point, Trincomali harbour entrance. The buoy painted red, with the words *torpedo buoy* on it, and surmounted by a red flag, is moored at a distance of $1\frac{1}{4}$ cables eastward of Small Sober island. p. 74.

The submarine mine field extends over the triangle formed by the buoy, N.E. Head Great Sober island, and Clappenberg point; vessels should pass between the buoy and Ostenberg point. Mariners are cautioned that the area above mentioned will probably be, from time to time, similarly blocked by submarine mines.*

Line 13 from bottom insert the number (12), the page referred to. p. 78.

Muletivu shoals.—According to an examination made by Captain Aldrich, R.N., in the year 1887, these shoals occupy a space about $8\frac{1}{2}$ miles long north and south, and extend $3\frac{1}{2}$ to $5\frac{1}{2}$ miles from the shore. The depths in the southern part vary from 6 to 18 feet, and the northern consisting of knolls varying in depth from 12 to 24 feet. p. 80.

Trincomali.—Coal.—5,000 tons of coal are usually kept in stock, and put on board vessels in lighters at the rate of 200 tons a day. p. 78.

There are sheers capable of lifting a weight of 12 tons; the depth alongside is 12 feet at low water.

* Originally published in Notice to Mariners, No. 3, of 1888. See Admiralty charts:—Caratievo to Pedro point, with plan of Trincomali harbour, No. 2081; Trincomali bay, No. 815; Trincomali harbour, No. 816.

CHAPTER III.

*Variation 1° 50' Easterly.*pp. 101
and 105.

Kárikal and Pondicherri.—Vessels can communicate by the International code of signals with the signal masts at Kárikal and Pondicherri.*

p. 102.

THIRUMALAVASAL.—A flagstaff for signalling purposes has been erected at the port of Thirumalavasal, which is situated in lat. 11° 14' 20" N., long. 79° 50' E. The flagstaff which is 75 feet in height, stands 35 feet to the northward of the custom house, a low tiled building on the western bank of the river.

Two boundary pillars marking the northern and southern port limits have also been erected on the sea-shore. Vessels should anchor with the flagstaff bearing from West to W.S.W. in 5 to 6 fathoms of water.

Caution.—The soundings shoal rapidly inside of 5 fathoms; vessels should therefore approach the anchorage with caution.†

p. 103

CUDDALORE.—The most convenient anchorage in the roadstead is with the flagstaff bearing N.W. by N., in 5 to 6 fathoms water. This bearing will place the vessel off the southern mouth of the river, and leave the shortest distance for boats to traverse.‡

p. 107.

Coast of Madras.—Doubtful Shoal.—H.M.S. *Investigator*, in the year 1887, sounded on the spot marked on the chart 5 fathoms doubtful, in lat. 12° 44' N., long. 80° 54' E., and obtained soundings in 1,700 fathoms, ooze.§

p. 107.

TRIPALÚR REEF—Shoal north-eastward of.—The existence of a shoal lying about $4\frac{1}{2}$ miles north-eastward of Tripalúr reef has recently been reported by Commander A. Carpenter, R.N., in charge of India Marine Survey.

This shoal (Rockingham patch), with a least depth of 11 feet, lies $1\frac{1}{4}$ miles from the shore. The outer edge, with $3\frac{1}{2}$ fathoms of water

* Originally published in Notice to Mariners, No. 32 of 1889. See Admiralty charts :—Cape Comorin to Coconada, No. 828; Madras to point Calimere, No. 71d.

† Madras Port Office notice, dated 19th June, 1888. See Admiralty chart, Bay of Bengal, sheet 4, Coast of Coromandel, No. 71d.

‡ Madras Notice, 15th January, 1889.

§ See Admiralty charts, Bay of Bengal, No. 70; sheet 3, No. 828; sheet 4, No. 71d.

over it, rocky bottom, lies with the following bearings and distance, viz.:—Covelong point, N. $\frac{1}{2}$ E.; Mahábalipur lighthouse (ruined pagoda), S.W. by S; Tripalúr hill, N.W. by W., distant $4\frac{1}{4}$ miles.

In passing this shoal, vessels should not go into a less depth than 13 fathoms.*

MADRAS—Landmarks.—The most conspicuous building as seen from seaward is the new post office, standing opposite the south arm of the breakwater, and whose lofty towers are visible at a distance of 15 to 17 miles. p. 109.

Harbour.—Repairs are being made to the breakwaters which were damaged in the year 1881. During the period 4th March to 19th April 1887, H.M. Indian troopship *Jumna* entered the harbour four times and discharged troops. Although surf was breaking at the T head, there was not sufficient to prevent landing at the pier from the steam pinnacle. The length of the *Jumna* is 360 feet; draft of water (aft) $23\frac{1}{2}$ feet. Five other vessels were inside the harbour at the same time as the *Jumna*. Vessels are usually moored with their heads to the eastward, with two anchors ahead and their sterns secured to a buoy. p. 109.

LEADING LIGHTS.—Two leading lights have recently been established in Madras harbour. p. 110.

The outer light, shown from the seaward end of the iron pier (N. 38° E. 1400 yards from Madras lighthouse), is a *fixed red* light, visible seaward through an arc of 112° , or from the bearing of S.W. $\frac{1}{2}$ W. to N. by W. $\frac{1}{2}$ W.; it is elevated 30 feet above high water, and should be seen in clear weather from a distance of 5 miles.

The inner light, shown from the roof of the Port Office (N. 21° E. 1290 yards from Madras lighthouse), is a *fixed green* light, visible seaward through an arc of 112° , or from the bearing S.W. $\frac{1}{2}$ W. to N. by W. $\frac{1}{2}$ W.; it is elevated 60 feet above high water, and should be seen in clear weather from a distance of 5 miles.

These lights kept in line lead through the centre of the harbour entrance, and are intended to guide vessels leaving the harbour, or making the outer anchorage, at night.†

* Originally published in Notice to Mariners, No. 127 of 1887. See Admiralty chart, Madras to point Calimere, No. 71d.

† Originally published in Notice to Mariners, No. 331 of 1888. See Admiralty charts:—Coromandel coast, with plan of Madras road, No. 71c.

p. 110. **Buoyage.**—The two buoys at the harbour entrance have been altered in position. The northern buoy, painted black and surmounted by a tripod, now lies 33 yards westward of the end of the remains of the north pier. The southern buoy, painted red and surmounted by a tripod, lies 33 yards westward of the end of the remains of the south pier. Lights are shown from these buoys when vessels leave the harbour at night.

Two buoys, painted red, have been placed northward of the harbour, for the use of vessels discharging cargo of a description which is not permitted to be discharged inside the harbour. The southern buoy lies in 5 fathoms water, $2\frac{1}{2}$ cables northward of the north pier, with Madras lighthouse bearing S.W. by S., and Sailors' Home flagstaff W. by N. $\frac{3}{4}$ N. The northern buoy lies in 5 fathoms water, 6 cables northward of the north pier, with Madras lighthouse bearing S.S.W. $\frac{3}{4}$ W., and Sailors' Home flagstaff S.W. by W. $\frac{3}{4}$ W.*

p. 112. **Time signal.**—An additional time signal has been established at Madras. The signal is a gun fired by electricity from a battery near the lighthouse, at noon, Madras mean time, equivalent to 18h. 39m. 0·6s. Greenwich mean time.†

p. 112. **Tides.**—In the months of October, November, and December the mean level of the sea is one foot higher than from February to May.‡

p. 114, &c. **STORM SIGNALS.**—The following storm signals (consisting of day and night signals) have been adopted at the ports of the Madras Presidency, instead of the flags hitherto used, and which are discontinued :—

DAY SIGNALS.

A **BALL** indicates the probable approach of dangerous weather.

A **DRUM** indicates that a cyclone is likely to approach the port.

A **CONE** apex upwards, at the flagstaff of the port, indicates that it is decided the shipping shall be ordered to sea, and signifies *cut or slip*.

NIGHT SIGNALS.

THREE LIGHTS, hoisted vertically, one above the other indicate, the probable approach of dangerous weather.

TWO LIGHTS, hoisted vertically, one above the other, indicate that a cyclone is likely to approach the port.

THREE BRIGHT LIGHTS, hoisted triangularly, one at the masthead, and one at each yard-arm of the flagstaff of the port, indicate that it is decided the shipping shall be ordered to sea, and signifies *cut or slip*.§

* Originally published in Notice to Mariners, No. 331 of 1888, and 264 of 1889. See Admiralty charts :—Coromandel coast, with plan of Madras road, No. 71c.

† Originally published in Notice to Mariners, No. 290 of 1887.

‡ Commander A. Carpenter, R.N.

§ Originally published in Notice to Mariners, No. 297 of 1887, and 449 of 1889.

Storm signals, practically identical with the above, are adopted on the coasts of Orissa and Burma.

Orissa coast.—Storm signal stations are established at Puri (Pooree), False point (at Huki tala), Balasor, and Chandbali.

Burma coast.—Storm signal stations are established at Akyab, Bassein, Rangoon, and Moulmein.*

Coal.—A supply of 2,000 tons of coal is usually kept in stock, and p. 115.
150 tons a day can be put on board.

Repairs to engines of 500 I.H.P. have been effected. Cylinders of 30 inches have been cast and bored. There are also two cranes capable of lifting 20 and 10 tons respectively.

Shoal.—The Government of India gave notice, dated 17th April p. 116.
1889, that a report has been received of the existence of a shoal, on which a steam vessel, drawing 19 feet, touched on 13th April 1889, lying about 3 miles southward of Pulicat shoals, and $3\frac{1}{2}$ miles from the nearest land. Position as given, lat. $13^{\circ} 17\frac{3}{4}'$ N., long. $80^{\circ} 24'$ E.

A shoal near this position was reported by the S.S. *Clan Mackintosh* in 1884, and removed from the Admiralty charts, having been unsuccessfully searched for in 1887.†

Caution is necessary when navigating near the coast between Ennore and Pulicat.

SACRAMENTO SHOAL.—Recent examination by Commander p. 125.
A. Carpenter, R.N., in charge of the India Marine survey has shown that the shoal consists of a sand bank, which nearly dries, its outer edge is distant 2 miles from the nearest shore, and the 10-fathoms line of soundings is 2 miles seaward of it. The sea always breaks on the shoal, except at the outer extreme; it lies with Hope island lighthouse bearing North, distant $13\frac{1}{2}$ miles.‡

Position, on Admiralty Charts, lat. $16^{\circ} 35\frac{1}{2}'$ N., long. $82^{\circ} 18\frac{1}{2}'$ E., or $4\frac{1}{2}$ miles N.E. of the position heretofore assigned it.

Thirthalmundi village, situated on a mound (with an obelisk among the huts) near the shore about $5\frac{1}{2}$ miles northward of Sacramento shoal, bearing N. by W., leads one mile seaward of it.

An arm of the Godavari river has formed two spits, the southern of which is named Sacramento spit. There is good anchorage in 4 fathoms water under the lee of the northern spit. Between the spits there is a channel into the river, with 9 feet on the bar at low water.

* Originally published in Notice to Mariners, No. 297 of 1887, and 449 of 1889.

† Originally published in Notices to Mariners, No. 127 of 1887, and 167 of 1889. See Admiralty charts:—Cape Comorin to Cocanada, No. 828; Coromandel coast sheet, 3, No. 71c.

‡ Originally published in Notice to Mariners No. 186 of 1889. See Admiralty charts:—Cape Comorin to Cocanada, 828 (1); Cocanada to Bassein river, No. 829; Coromandel coast, sheet 1, No. 71a.

CHAPTER IV.

Variation 2½° Easterly.

p. 139. **BARUVA or BARWA.**—The black column hitherto difficult to distinguish is now painted in horizontal bands of black and white, the upper band being black.

pp. 140—**Gopalpur to Mahanadi river.**—By a recent survey of the coast, undertaken by the Marine Survey of India, the coast was found to be free from submerged dangers, but the 10-fathoms line of soundings frequently extends to within three-quarters of a mile of the breakers on the shore. Between Gopalpur and the Dévi branch of the Mahanadi the 20-fathoms line of soundings varies from 5 to 13 miles distant from the shore. The 100-fathoms line was found at a fairly uniform distance of 18 miles.*

A small bank projects half a mile seaward of the entrance of Chilka lake, and a similar bank projects three-quarters of a mile seaward of the Devi. There is a channel having 8 feet at low water into the Devi. The northern mouth of the Mahanadi appears to have closed, and the breakers off the southern mouth are now extending seaward.

Distances judged by the eye on this coast are very deceptive; caution is therefore requisite.

p. 140. **Gopalpur.**—A pier is in course of construction at Gopalpur. In May, 1887, the pier extended 700 feet from the shore, and at the extremity there was a depth of 10 feet at low water. A *red* light is exhibited from the extremity of the pier (*See* page 62). The light will be moved seaward as the works progress.

p. 147. **FALSE POINT.**—A signal staff, for signalling purposes only, has been erected at the western end of the new refuge house, Haki Tali, on the western side of Dowdeswell island. The staff consists of a lower mast and top mast, the truck of which is 73 feet above high water, with a yard, the whole painted white.†

* *See* Admiralty charts—Cocanada to Bassein river, No. 829; The Sand Heads, False point to Mutlah river, No. 814; Entrances of the Mahanadi and Davey (Devi) river, No. 756.

† Originally published in Notice to Mariners, No. 261 of 1888. *See* Admiralty Chart—False point anchorage, No. 755.

Beacon.—The tripod beacon having been blown down, was re-erected in a position 400 feet N.W. from the old site.*

A new screw pile beacon has been erected in a position 83 yards N.N.W. of the present Tripod beacon. The Cross beacon on Reddie head has been shifted 200 yards to the N.N.W. of its present position, so that the Cross beacon in line with the new screw pile beacon is now the anchoring mark for steamers drawing 20 feet and upwards.†

DHAMRA river.—Short island.—The beacon has been moved, and now bears from the lighthouse E. by N. $\frac{1}{2}$ N. 410 feet. In approaching the entrance the bearing of the lighthouse and beacon in line W. by S. $\frac{1}{2}$ S. is a good guide for vessels to stand towards Kanaka buoy should the Patmyros buoy have drifted.‡

Buoy G has been altered in colour, and is now painted black and white stripes, surmounted by staff and basket. In September 1887, the best track over the outer bar was to keep C buoy nearly in line or a little open northward of G buoy.§

* Calcutta Notice to Mariners, No. 67 of 1887.

† Calcutta Notice to Mariners, Nos. 89 and 99 of 1889.

‡ Calcutta Notice to Mariners, No. 53 of 1887. See Admiralty chart—Dhamra river, No. 754.

§ Calcutta Notice to Mariners, No. 31 of 1889.

CHAPTER V.

Variation 2½ Easterly.

p. 158. **BALASOR river.**—Tidal signals.—At high water the blue ensign will be hoisted at the eastern yard arm of Chandipur flagstaff, southern side of entrance, and kept so until the tide begins to fall; it will then be dipped 6 feet, and kept so until the tide has fallen 3 feet, when the ensign will be hauled down and hoisted at the masthead.

At low water the blue ensign will be hoisted at the western yard arm of the flagstaff, and kept so until the tide begins to rise; it will then be dipped 6 feet, and kept so until the tide has risen 3 feet, when the ensign will be hauled down and hoisted at the masthead.

These signals will not interfere with the custom of hoisting the ensign at the masthead on the approach of vessels.

p. 172. **HÚGLI river.**—**LONG SAND Light-vessel** will in future be maintained in position during the whole year, instead of only from 1st February to 30th November annually, as heretofore.*

p. 175. **Calcutta.**—Repairs of engines are undertaken. Cylinders of 80 inches have been bored and shafts 16 inches in diameter turned. There are 2 cranes capable of lifting 5 and 7 tons respectively.

Coal.—Upwards of 15,000 tons of coal are kept in stock, and 500 tons a day can be put on board.

Alongside the P. & O. Company's jetty there is sufficient depth for any vessel that can ascend the river: at the government jetty a depth of 18 feet at low water springs during the dry season.

p. 177. **Storm signals.**—The following cautionary signal has been adopted in connection with the previously existing storm signals for the port of Calcutta and approaches. Two balls, hoisted vertically, indicate the existence of disturbed weather in the northern part of the bay of Bengal. The disturbed conditions may consist of squally weather with strong winds to the southward, which may shortly pass away, or which may be the first stage in the formation of a cyclonic storm.

p. 181. **Bores.**—The bores in the Húgli occur only on the highest, or at alternate spring tides; their appearance may, with certainty, be

* Originally published in Notice to Mariners, No. 23 of 1889. See Admiralty Chart—The Sand heads, False point, to Mutlah river, No. 814; river Húgli, &c., No. 136.

predicted by the season of the year and the parallax of the moon. During the months of November, December, January, and February, or on the periodical ebb of the sea, when the currents are setting down the Bay, the tides, as may be supposed, are languid, and, consequently, during this period there are no bores.*

As soon as the south-west monsoon sets the currents up the Bay, the sea begins to rise, the tides become strong and high, and bores follow in their train; whenever the parallax of the moon is high on the springs during the south-west monsoon, bores will certainly make their appearance, and when strong southerly winds are added, and freshes withheld, the height of the bores will be increased.

Approach to CHITTAGONG.—The following information pp. 189, concerning the approach to Chittagong, in the north eastern part of 195. the bay of Bengal—the result of a recent examination—is from Commander A. Carpenter, R.N., in charge of Marine Survey of India:—

MEGHNA FLATS.—Between longitudes 90° E. and $91^{\circ} 30'$ E., no important extension of these banks appeared to have taken place since the last survey. The southern extreme, between these limits, is situated in lat. $21^{\circ} 24'$ N., long. $90^{\circ} 18'$ E.

Shoal.—The shoal, reported by the port officer at Chittagong, in August 1882, as situated in lat. $21^{\circ} 55' 40''$ N., long. $91^{\circ} 22' 30''$ E., with a depth of 15 feet at low water, was unsuccessfully searched for. A shoal, with a depth of 15 to 18 feet, was, however, found in lat. $21^{\circ} 58'$ N., long. $91^{\circ} 26' 30''$ E., and is considered to be identical with the former, which has been removed from the chart.

Soundings.—The whole of the Meghna flats consist of gray sand, very fine, and nearly white in 10 to 20 fathoms but darkening with black specks as the depths decrease. More mud will be found as the vessel goes northward, but being soft it will wash off and leave only the sand unless the ship's way be stopped.

* Except very rarely—in twenty-two years—I (Mr. Kyd) have known but three instances. Agreeably to the statement of local causes which accelerate or depress the tides, it will be obvious that, during the north-east monsoon, if the winds which blow the waters down the bay be more than usually moderate, and the moon's parallax be high, there may be a high tide, and with it a bore, and this, agreeably, to the third local cause, will happen at night. These night bores are particularly dangerous, as they are very rare, and consequently unexpected. They may be guarded against by always considering it possible for them to occur during the north-east monsoon at night, upon a high parallax of the moon. Agreeably to the same local cause, it is fortunate that the bores at night, during the south-west monsoon are not so high as in the day.—[The preceding remarks are extracted from an article in "Asiatic Researches," Vol. 18, page 266, published in Calcutta, 1833.]

Tides.—Off the elbow of the flats in long. $90^{\circ} 20'$ E. it is high water full and change at 9h. 30m. On the eastern edge of the flats, shortly before high water, an under current, warmer than the surface water, was found to set N.E. and E. In depths of 5 fathoms and under, there is always a swell for the first half hour of the flood stream.

It is high water, full and change, at Kutabdia island at 12 hours, springs rise 15 feet, neaps $9\frac{1}{2}$ feet. At South Patches, springs rise 12 feet. The flood stream runs N. by E. and N.E. for one hour after high water. The ebb stream continues to run to S.S.W. and S.W. for $1\frac{1}{2}$ hours after low water at the place; the rate of the ebb at springs has been variously estimated at from 4 to 6 knots per hour; at neaps, about $2\frac{1}{2}$ knots. At springs the streams run northward and southward; but at neaps the set becomes circular, moving round with the hands of a watch. During the fine season the westerly stream continues for a longer period than the easterly.

p. 196. **South patches.**—A depth of 7 feet was found on the northern part of these shoals, distant about half a mile from the north extreme.*

A spar buoy with spire and cage has been laid off the South patch shoal in lat. $21^{\circ} 30'$ N., long. $91^{\circ} 38\frac{1}{2}'$ E. The spar floats nearly upright, is painted black, and can be seen at a distance of 2 miles.†

p. 195. **Kutabdia anchorage.**—There is anchorage with Kutabdia light bearing E.N.E. distant about one mile. Vessels may safely approach by night by steering with the light bearing E.N.E.; this leads over a narrow ridge of $4\frac{1}{2}$ to 6 fathoms S.S.W. of Dolphin shoal, but the lead may easily miss it. Before sounding on the shelving bank off the lighthouse the depths will have increased to 9 fathoms, after which the anchor may be dropped in 7 fathoms, about a mile distant from the light. Here the anchorage is fairly protected, but the current runs quite as strong as outside the shoals.

p. 199. **CHITTAGONG (Karnafuli) river.**—The bar at this river has changed since the year 1883 and Patunga mud flat has encroached on the channel. The white pillar on the hill in line with large

* Originally published in Notice to Mariners, No. 204 of 1887. See Admiralty charts :—Cocanada to Bassein river, No. 829; Mutlah river to Elephant point, No. 859.

† Calcutta Notice to Mariners, No. 28 of 1889.

triangle is no longer a guide. Vessels should keep close to the outer black buoy, and steer up for the middle red buoy, until Leading tree is in line with disc and triangle.

The outer red bar buoy has been shifted one cable S.S.E. and the middle black buoy one cable S.E. by E. from their former positions. The semaphore shows the height of the tide on the bar.*

STORM SIGNALS have been established at the port of Chittagong. These signals will only be used to give warning of the early approach of a severe cyclone, with its attendant storm wave. They will be hoisted on the yard arm of the flagstaff at Sudder Ghât, and on the yard arm of the flagstaff on Júldia hill, on the receipt of instructions from the Meteorological Department, as follows :— p. 200.

Day signals.—A ball indicates that a severe cyclone, of which the centre is in the neighbourhood of Akyab, will probably advance towards Chittagong.

A drum indicates that a severe cyclone, with its attendant storm wave, is approaching Chittagong.

Night signals.—Three lights, placed vertically, indicate that a severe cyclone, of which the centre is in the neighbourhood of Akyab, will probably advance towards Chittagong.

Two lights, placed vertically, indicate the early approach of a severe cyclone, with its attendant storm wave, towards Chittagong.†

* Calcutta Notice to Mariners, No. 93 of 1889. See Admiralty chart Chittagong river, No. 84; scale, $m = 2\frac{1}{2}$ inches.

† Originally published in Notice to Mariners, No. 152 of 1888.

CHAPTER VI.

Variation 3° Easterly.

p. 211. **Akyab.**—About 1,300 tons of coal are usually kept in stock. 200 tons can be put on board in a day.

pp. 215,
218, 219. **KYAUK PYU harbour—Saddle Island—shoals.**—Commander A. Carpenter, R.N., has communicated the following information relative to the existence of shoal ground westward of Saddle island, southern side of entrance to Kyauk Pyu harbour:—

A chart of Kyauk Pyu harbour, dated 1832, by Captain Ross, I.N., shows two dangers one mile westward of Saddle island; breakers having been seen in that position before the survey. Also, the Indian surveying vessel *Investigator* found a depth of $4\frac{1}{2}$ fathoms, nearly in the same position on leaving Kyauk Pyu harbour in 1885; and a British India steam-vessel has since reported that shoal water has been seen in that locality.*

Mr. J. R. P. Alexander, master of the British India Company's vessel *Madras* also reports having seen heavy breakers westward of Saddle island, in a position $2\frac{3}{4}$ miles W. by N. $\frac{1}{2}$ N. from Cap island. From the appearance of the breakers which were seen on two separate occasions it was considered there could not be much water on the shoal.

Vessels should not pass between Irrawaddy shoal and Saddle island.

p. 230. **SANDOWAY River Approach—Four-fathom shoal.**—The Four-fathom shoal, situated 30 miles south-eastward of Chedúba island, has a least depth of 10 feet over it, and is composed of large stones. Its position is S. by E. $\frac{1}{2}$ E., distant $1\frac{1}{2}$ miles from that previously charted. Corrected position, on Admiralty chart, lat. $18^{\circ} 14' N.$, long. $94^{\circ} 3' 15'' E.$ †

* Originally published in Notice to Mariners, No. 208 of 1888. See Admiralty charts:—Elephant point to Chedúba strait, No. 821; Kyauk Pyu harbour, No. 831.

† Originally published in Notice to Mariners, No. 290, 1887. See Admiralty charts:—Chedúba strait to Koronge island, No. 822.

CHAPTER VII.

Variation 2° Easterly.

NICOBAR islands—St. George's channel.—At a distance of $1\frac{1}{4}$ miles from the north-east point of Great Nicobar is a shoal, having a depth of $2\frac{1}{2}$ fathoms. The bearing of the shoal from the point is not known.* p. 245.

ANDAMAN ISLANDS.†—The natives are rapidly learning Hindustáni, and their own dialects are dying out. They are everywhere friendly now except at the south end of Little Andaman. At North Sentinel they are still shy, but not aggressive, and the crews of vessels wrecked on these islands may now be sure of their friendly aid provided they address them properly. With a little persuasion they will send a message to port Blair, or guide a shipwrecked party through the dense jungle to that port. It should be remembered that they are timid, and the least rough usage will result in their sudden retirement into the bush. p. 254.

Fauna.—Wild pigs exist on all the islands. Turtle are also numerous. The tree lizard is common. Snipe and doves increase in numbers every year where there is cultivation. The Nicobar pigeon exists on some of the off-lying islands and the large gray pigeon lives in the thicker parts of the forests.

Snakes are not numerous, but an immense cobra, the Hamadryad, is occasionally seen. The edible birds nest swallow builds wherever caves exist, and two or three other kinds of swallows are common.

Flora.—The flora resembles that of Burma, but the forest trees are finer, being very lofty and straight. Padauk, a heavy red wood, much prized for furniture, and marble wood of a black mottled texture are exported. Didu wood is also used for tea boxes. The bamboo grows at the north end of South Andaman, but is scarce farther south. Cocoanuts are now being rapidly introduced.

* Pola Hydrographic Notice, No. 6 of 1887. See Admiralty chart, Nicobar islands, No. 840.

† The following remarks on Andaman islands are due to Commander A. Carpenter, R.N., in charge of Marine Survey of India, 1888.

Climate.—The following table exhibits the average from 1882–1888.

Month.	Weather.
October	Variable wind and weather ; water spouts, 10 inches of rain.
November	The first half of the month the same as October, afterwards N.E. monsoon and little rain. A cyclone is almost certain to blow in November.
December	Fresh N.E. monsoon, fairly cool ; 6 inches of rain.
January	Cool and pleasant, no rain, N.E. winds ; nights sometimes foggy.
February	Cool and pleasant, very clear, light airs, no rain.
March	Hot by day, cool nights, no rain, light airs, occasional haze.
April	Very hot, no rain, calm and hazy.
May	S.W. monsoon sets in about the 15th ; 15 inches of rain.
June	S.W. monsoon, cool, squally ; 16 inches rain.
July and August	Same as June.
September	Rain every day. S.W. winds ; 23 inches rain.

NOTE.—On the west side of the islands the N.E. monsoon frequently blows from North or North-west.

Mineralogy, &c.—The Andaman islands form a continuation of the line of elevation constituting the Arakan Yoma, and the geological formations are similar.

At Rangochang, a few miles south of port Blair, there is iron, copper and sulphur ore, the copper being slight. Chromite is found at Rutland island and at Chakargon. There is some serpentine at Homfray's Ghát and some jasper at Aberdeen. Limestone crops up at several places near port Blair, and might prove useful for ornamental work, being of a mottled grain. Sulphur is still being deposited at Barren island.*

Little Andaman island.—The bank situated 7 miles W.S.W. of Sandy point, the south-west point of Little Andaman, has been examined. There are some rocky ridges in the centre, partly overgrown with weeds and having $5\frac{1}{2}$ fathoms water over them. The centre of the shoal is in lat. $10^{\circ} 31' N.$, long. $92^{\circ} 13' E.$ During the S.W. monsoon the rollers on the bank are probably dangerous.†

p. 255.

South Sentinel is a small uninhabited level-topped island with a low point on its south side. It is 144 feet high to the top of the trees, and has much the same appearance on any bearing. It is separated from Little Andaman by deep water, and it stands on a bank which trends 7 miles to N.W. of it with depths of 12 to 30 fathoms, dead coral. It bears South distant 32 miles from North

* See Admiralty chart, Andaman islands, No. 825.

† The chart of Andaman islands as regards that portion from the parallel of Port Blair southward to Little Andaman is under extensive correction. A new chart of the portion mentioned will shortly be published.

Sentinel. There are no dangers round it much outside the fringing reef, and no landing on it except on the north side in fine weather. The west side is the most shelving, and anchorage can be had, in 14 fathoms, 8 cables W. by N. of the centre of the island with the extremes of the island subtending an angle of not more than 35°.

Turtle are plentiful here, and there are great numbers of the robber crab.

The Brothers are two small flat-topped islands, lying 7 and 11 miles N.E. by E. of the north point of Little Andaman. They are each about 90 feet high, wooded to the water's edge, with a fresh water lagoon in the middle of each. A small reef surrounds North Brother, and between the two islands is a detached patch known as Leeboard ledge. The passage between the Brothers is not recommended.

A dangerous reef extends N.W. by N. from South Brother and generally breaks near the end about $2\frac{1}{2}$ miles from the island, but foul ground extends 5 miles N.W. by W. from the island, or 3 miles west of the breaking reef. At 7 miles distant there is deep water. Between South Brother and Little Andaman there is a channel $5\frac{1}{4}$ miles wide, but a detached reef, known as Ariel ledge, occupies the centre of the channel W.S.W. of South Brother, and thus narrows the channel considerably; the soundings are also so irregular that the passage is not recommended.

A reef also projects S.E. by E. from South Brother.

Great numbers of gray pigeon breed on South Brother.

Duncan passage.—Care should be taken not to bring the Northern Brother to bear North of East whilst the east extreme of Little Andaman bears to the South of S.S.E. By attending to this the foul ground N.W. of the South Brother will be avoided.

THE SISTERS, on the north side of Duncan Passage, stand on a bank of 5 to 12 fathoms, coral, and the 100-fathoms line passes within $1\frac{1}{4}$ miles east of them. A rocky spit extends 7 cables N.W. from the ledge connecting the two islands. The Northern island is 306 feet high. p. 256.

PASSAGE ISLAND is 351 feet high, and about three-quarters of a mile in extent. Its north end is high and rounded, and is so seen when first sighted, but the south end is low. p. 256.

A detached rock 6 feet high lies 3 cables N. by W., and a bank having $6\frac{3}{4}$ fathoms least water lies 2 miles W.S.W. from the north end of the island. The latter consists of a narrow rocky ridge fringed with sand. At spring tides there are overfalls. The channel

between Passage island and the Cinque islands is safe, but there are tide rips at spring tides. It is 3 miles wide, and has an average depth of 28 fathoms.

CINQUE ISLANDS, consisting of two hilly narrow islands almost joined by a rocky ledge awash at high water, are moderately high, and lie in a N.N.E. and S.S.W. direction 3 miles off the south-east coast of Rutland island, forming, with that island, a passage called Manners strait. The trees on both islands are most remarkably contorted by the south-west monsoon.

North Cinque island has two summits, forming a saddle, about 570 feet high, and near its south end is a small conical bare hill, from which a low promontory projects westward, forming a bay. Depths of 9 to 10 fathoms dead coral and sand will be found, with the west point of the island bearing N. by W.

South Cinque island is 545 high and larger, with also a conical knoll at its south end. Both the islands are fairly steep-to, and the only anchorage is west of the sunken ledge joining them.

Manners Strait, between Cinque islands and Rutland island, is 3 miles in breadth and free from dangers. There is usually a tide rip across it at any time. This passage is the one preferred by steamers running to or from port Blair, and with a leading wind would be preferable to Duncan passage for sailing ships.

Rutland Island.—The northern half of this island is high, and culminates in a peak, mount Foord, 1,422 feet high. The southern half is of moderate height, 744 feet, and is joined to the northern by a low neck of land formed by two bays.

The eastern of these, known as Portman bay, is a deep indentation, having a mangrove swamp and shallow water at its head and irregular deep soundings in the centre. A considerable swell sets into it in the north-east monsoon. The western, called Wood-Mason bay, has its northern side filled up with reef, but the south part of it appears to be clear of shoals. The whole island is densely wooded, which may be said of the whole Andaman group. Its shores are difficult of access, and the natives are not so friendly as on South Andaman.

Off the south point of the island a bank of boulders extends nearly a mile seaward and there are some irregular patches beyond. It will be well therefore not to approach the south coast within $1\frac{1}{2}$ miles except at the narrows of Manners strait where the coast is steep to. A large bank of dead coral, about 4 miles square, having not less

than $6\frac{3}{4}$ fathoms of water over it, lies with its centre $6\frac{1}{2}$ miles S.W. of the south-west point of Rutland island, and is quite safe to pass over in ordinary weather.

THE TWINS are two level topped wooded islets, 150 feet high p. 257. to the top of the trees, lying close off the south-west side of Rutland island. They stand on a reef, and a dangerous ledge projects $1\frac{1}{2}$ miles to the S.W. from the West Twin. About half way out on the ledge a turtle-backed rock is visible except at high water, when it is covered.

LABYRINTH ISLANDS consist of fourteen islands, all rocky and fringed with coral reefs; the largest is 3 miles long. On their seaward face the coral reefs project nearly a mile out, and large blocks are broken off by the sea during the south-west monsoon and are thrown on to the reef, giving an appearance as of rocky boulders. The channels between the islands are nearly full of coral heads, but the passage between the two south-eastern islands, Malay-Tapu and Jolly Boys island, is clear in comparison, and leads to the western end of Macpherson strait. The islands and shoals adjoining the track into this strait will now be described.

Boat island, $1\frac{1}{2}$ miles long, half a mile broad, and 200 feet high, is the south-western of the group, and has a coral reef projecting from it one mile to the southward. Natives resort to this island for fishing.

Jolly Boys island, lying close to Rutland island, has coral reefs extending 6 cables S.W. of it and 2 cables W. and N.W. of it. This reef is generally visible.

Malay-Tapu, lying one mile N.N.W. of Jolly Boys, has a rounded summit at its north end. A rocky ledge extends off its south point, and has been marked near its extreme with a perch.

Hobday island, the next to N.E. of Malay-Tapu and almost touching it, has a rocky ledge extending off it half a mile towards the north point of Jolly Boys, and this continues under water, forming a ridge of $4\frac{1}{2}$ fathoms, and crops to the surface again in Beauchamp patch.

Beauchamp patch is a small coral head nearly awash at low water springs, but not often visible by its discolouration, $3\frac{1}{2}$ cables N. by E. $\frac{1}{2}$ E. from the north point of Jolly Boys. It has been marked by a perch.

Pluto island, small and rounded, lies by itself east of Hobday island, and is useful as a leading mark. Brooker rock, a dangerous pinnacle of rock with only 5 feet over it at low water, lies $8\frac{1}{2}$ cables

S.W. by S. of the south point of Malay-Tapu. There is a depth of 5 fathoms close to.

Peck shoals are a cluster of coral heads lying to the north of the channel.

p. 256.

MACPHERSON STRAIT.—The western entrance is narrow and much hampered by coral reefs. Both shores of the strait are fringed with coral reef, on the edges of which pieces show above water. In the strait proper there is only one danger, which is about half way through, and consists of a ledge of rocks which projects from the Rutland shore $4\frac{1}{2}$ cables E.N.E. into the channel. A perch has been erected near the extreme, but if it is washed away the locality of the ledge can always be made out, and a vessel will clear it by keeping to the northward until the western entrance is shut in by the northern shore. The eastern entrance point, Chiriyá-Tapu, is a conspicuously bare promontory, under which are some caves in which edible birds' nests are found. A rock which never quite covers lies half a mile to westward of the point, and has deep water to westward of it. Vessels should not pass between the rock and the point. *

Directions from Westward.—Bring Jolly Boys island to bear N.E. $\frac{1}{2}$ E. and steer for it; when 3 miles from it Pluto island, which is small, will be seen lying well back in the bay to the north of Jolly Boys island but to the right of the remainder of the group. When Pluto island becomes two-thirds of its length open clear of Malay-Tapu (which clears Brooker rock) haul to N.E. by N. so as to pass Jolly Boys reef, which is generally visible, at $2\frac{1}{2}$ cables distant on the starboard hand, and follow it along at that distance, taking care not to bring Pluto island any closer to Malay-Tapu. When the south point of Jolly Boys island is bearing about S. by W. the entrance of Macpherson's strait should be bearing E. $\frac{1}{4}$ S. From here steer E. by N. $\frac{1}{2}$ N., which leads between Beauchamp patch and Peck shoals, until the strait opens out, when steer through in mid channel, avoiding the rocky ledge half way through as before described. At springs there is a good deal of discolouration which hides Brooker rock and Beauchamp patch, but the tide whirls are not strong, and its strength is only felt in the narrows north of the islet which marks the actual western entrance point. As long as the south point of Boat island is not shut in by Malay-Tapu a vessel will be clear of Peck shoals. The flood sets to eastward and turns to westward at the time of high water, and the west-going ebb turns to eastward at low water.

* See foot note, p. 28, as to intended publication of a new chart embracing this portion of the Andaman islands.

There is anchorage in 6 to 10 fathoms in the northern part of the eastern half of the straits with Chiriya-Tapu point bearing S.E. by E. distant $1\frac{1}{2}$ miles.

NORTH SENTINEL ISLAND is about 15 miles west of p. 257. Labyrinth islands, the channel between being clear and carrying about 45 fathoms, the bottom being ooze. It is 400 feet high to the top of the trees and has a level ridge, which however slopes to a very low north-west point. The shape of the island is nearly square and its sides are each 4 miles in length. A coral reef nearly surrounds the island at a distance of half to three quarters of a mile from the shore and the lagoons between the reef and the shore have depths of 3 to 8 feet. There are several entrances through the reefs fit for boats and there is anchorage outside all of them for a vessel in the fine season. Four islets stand on the reef, the largest being at the south-east corner of North Sentinel.

The best landing place and anchorage is however on the east side of the island where 10 fathoms may be obtained half a mile off shore with the north-east point bearing N.W. by N. South of this there are sunken dangers.

The island is seldom visited by Europeans. The natives are very shy.

There are no dangers outside the reefs, and the 100-fathom line passes 3 miles West of the island.

Barren Island is 2 miles in diameter and the outer slope of the crater is covered with foliage. On the western side the crater wall is broken down and permits a view of the interior. Here is the landing place, in a nook formed by an outflow of lava through the gap in the crater wall. A hot spring trickles through the beach at the landing place and its temperature in 1886 was 110° Fahrenheit. The volcano was last seen to be active in 1803 but has ejected lava since that date. Since 1857 only a thin column of steam has issued from the summit. There are no dangers round the island at half a mile distant and it slopes regularly to the floor of the ocean, here 1,100 fathoms deep. There is anchorage in 14 fathoms $2\frac{1}{2}$ cables off a beach on the south-west side of the island. There is no water on the island in the dry season except the hot spring, the water of which is just palatable when cooled. There are great numbers of rats.

NARKONDAM ISLAND.—Several small rocks above water p. 258. lie close round its sides within 80 yards of the shore but there appear to be no dangers outside of these. At half a mile from the

shore the depths average 120 fathoms, but on the N.N.W. side of the island there is an islet or large rock which forms some shelter for landing and there is said to be anchorage one cable West of it.*

The Andamanese never visit Narkondam now, but Burmese fishing boats have been known to be driven there and to Barren island.

p. 258.

SOUTH ANDAMAN.—PORT BLAIR.—The north entrance between North point and Ross island is $1\frac{1}{4}$ miles in width with depths of 23 to 30 fathoms. Immediately west of North point is North bay, an arm of the harbour which is not used, and which has a beautiful coral reef fringing its shores. One mile westward of North bay is Semiramis or Hope Town cove where there is a pier alongside of which the water boats are filled for watering ships.†

Mount Harriet, 1,193 feet high, is situated about $1\frac{1}{4}$ miles inland north of this cove and is sometimes used as a sanatorium, a good road leading to it from the pier. On the west side of Command point, which is the west arm of Semiramis cove, are the coal sheds and piers, alongside of which large vessels can go to coal. Two buoys are provided for the off shore hawsers; the piers are not quite long enough to keep a vessel's bilge off the edge of the fringing reef but there is plenty of water at a distance of ten feet outside the piers. Sufficient coal is kept for ordinary requirements of vessels of war.‡

Half a mile west of Command point is Bamboo Flat bay, at the head of which is a foundry and smithy, and a boat building shed. Small repairs to iron work of ships can be done here. Brigade creek, a mangrove course, debouches immediately west of Bamboo Flat bay and causes a projecting shoal of mud and sand that stretches nearly half of the distance across to Chatham island.

VIPER ISLAND, the present site of the convict jail, is covered with buildings one of which is a blanket manufactory. Westward of this island the harbour is quite shallow.

Navy bay, east of Viper island, is a fine sheet of water but the depths vary from 18 to 23 feet and there is not much accommodation at the latter depth. At the head of the bay are saw mills and the principal rifle range, whilst overlooking it from the southward are extensive tea gardens.

* The name Narkondam appears to be derived from Naraka-Kundam, signifying "a pit of hell," and was probably meant for Barren island but a confusion of names has since arisen.

† It was on this pier that Lord Mayo, then Viceroy of India, was assassinated on the 8th February, 1872.

‡ See plan port Blair, No. 514; scale, $m = 4.2$ inches.

CHATHAM ISLAND, $2\frac{1}{4}$ miles west of Ross island, is now only used for saw mills. It is steep to on its northern side but its south side nearly joins Blair reef, a rocky ledge which extends from Aberdeen peninsula. The east extreme of Blair reef bears E.S.E., 6 cables from Chatham island and partly covers the entrance of Phoenix cove, a small inlet on the Aberdeen side which is used for repairing boats. A buoy with a staff is placed at this extreme of the reef. Vessels may avoid Blair reef by keeping the extreme of Shore point (north side of Brigade creek) open of Chatham island and bearing N. 69° . W.

ROSS ISLAND, on the south side of the main entrance to port Blair, is about three-quarters of a mile in length north-east and south-west, by 3 cables in width, and about 150 feet high. At the north end are some handsome castellated barracks, near to which, on the highest part of the island, is Government house, approached by a road terminating in a wooden pier on the western side. Commissariat stores, mechanical workshops, a boat building yard and a general hospital are on Ross island. The hospital admits all free persons, for whom there are fixed fees. No vessels are allowed to visit port Blair for commercial purposes except under Government contracts, but vessels wishing to visit and trade at the Nicobars are obliged to call here first and obtain a permit to do so. The Asiatic Steam Navigation Company's steamers arrive every four weeks from Calcutta; and they also bring an intermediate mail from Rangoon. p. 259.

The number of convicts in port Blair in April 1888 was 11,588. Of these 3,078 were allowed to support themselves by agriculture, &c. but not to leave the islands. The average number of convicts sent to port Blair annually is 1,200.

A detachment of a European regiment and a wing of a Native Infantry regiment act as a guard. The Police force numbers 643 of all ranks, and they are a semi-military body. The port is healthy now that the forest in the immediate vicinity has been cleared away. Two barracks are reserved for quarantine arrangements at Perseverance point, but have not yet been used. Tea, coffee, cocoa paddy, Indian corn, and vegetables are cultivated. The edible birds' nests are now worked by Government and yield a revenue of about Rs. 4,000.

Anchorage.—The best anchorage in the harbour is that W.S.W. of Chatham island, where there are depths of 7 fathoms mud and perfect protection.

The anchorage always used is that between Ross island and Aberdeen, and although somewhat confined, has the advantage of having two

entrances. A reef projects 3 cables to the N.W. of Ross island and assists to protect the harbour. Two red buoys, one at the north extreme and one at the west, are anchored in 7 fathoms just clear of the reef and lead into the anchorage, west to S.W. of the wooden pier, in 8 fathoms.

Sesostris shoal, a coral patch lying half a mile off shore one mile S. by E. $\frac{1}{4}$ E. of Ross island, is the chief danger off the southern entrance. The shoal is marked by a red buoy, which is moored in 8 fathoms on the eastern edge, and may be cleared by keeping the white-washed house on Command point bearing N. 49° W. open of Atalanta point, the north-east extreme of the Aberdeen shore.

In approaching Ross island anchorage from the southward, after passing Sesostris shoal bring Command point to just touch Atalanta point which leads through past the rocky ledge off Ross island. When the wooden pier bears N.N.E., haul up towards it and anchor as convenient.

Position.—The Port Officer's stone jetty is in lat. $11^{\circ}40'34''$ N., long. $92^{\circ}44'55''$ E.

Tides.—It is high water, full and change, at port Blair at 9h. 54m. Springs rise 7 ft.; neaps rise $4\frac{1}{2}$ ft.; neaps range $1\frac{1}{2}$ ft.*

p. 260.

The coast of South Andaman island from port Blair southward to the entrance of Macpherson strait at the south end of the island, a distance of 13 miles, is bold and free from danger. The 100-fathom line here approaches the coast to within a distance of 2 miles. North of port Blair the coast is also bold and straight, and trends in about a N. by E. direction for about 14 miles to Shoal bay. The land above this part rises in a broken ridge, and is 1,193 feet high near port Blair, to which it descends rapidly, and thus pointedly indicates the locality of the port.

Shoal bay extends in a W. by S. direction for 3 miles and then turns to southward for 7 miles, being a narrow inlet between the hills. At its entrance it has a depth of $4\frac{1}{2}$ fathoms, rapidly shoaling however to depths of one to 3 fathoms. It is fringed with mangroves, but the hills are clothed with fine forest trees, which are here cut for export. Off the north end of Shoal bay is Kyd island, a lofty rounded hill.

p. 261.

ANDAMAN STRAIT.—**Eastern entrance**, separating South Andaman from Middle Andaman and Baratán island, is narrow and intricate, its eastern end being blocked by a bar, the depth over which

* Directions adapted to a re-survey made by the officers of the Marine Survey of India, 1888. Little change was found since the survey of 1861.

is from 9 to 10 feet at low water. It is a natural channel amongst the undulations of the hills, which are lower at this part of the Andaman range than elsewhere. The channel is narrowed at one or two points to about 80 yards, its general breadth being from 2 to 3 cables. A depth of 10 to 14 fathoms is generally found throughout the narrow part of the strait. The bottom throughout is mud and sand, and one or two ridges of shallow water cross it, but nothing less than 3 fathoms at low water. About half way through, where the trend of the strait changes from north and south to east and west, there is an island, Orol-Kaicha, which may be passed on either side, but the channel round the north side of the island has more moderate curves. Near Spike island, at the west end of the strait, the bottom becomes foul; attention must therefore be paid to the directions mentioned further on under "Spike Island" (page 39). H.M.I.M.S. *Investigator*, drawing 13 feet, passed through this strait three times in the year 1888 whilst surveying the islands. The stream through the strait is never strong.*

Directions.—From the eastward the entrance to the strait is not easy to distinguish. It is a low mangrove bay 3 miles north of Entry island (Port Meadows). Off either extreme of the bay are ledges of rock, and the bay should be approached from the eastward. The channel in on this side lies towards the north shore, and the inner north entrance point should be brought to bear W. by S., steered for on that bearing, and rounded at a distance of one cable.

Henry Lawrence island.—Janes patch, marked on the chart p. 262. in lat. $12^{\circ} 9' N.$, long. $93^{\circ} 12' E.$, does not exist, and has therefore been expunged from the charts.

DILIGENT STRAIT, between Middle Andaman and Henry p. 263. Lawrence islands, has been surveyed, and found free from danger except between Strait island and Wilson island (formerly known as Round hill point).

A shoal with a depth of 2 fathoms lies one mile north of the north-west point of Wilson island (Round hill point).

South Button island, just touching the north point of Outram island, bearing N.E. $\frac{3}{4}$ E., leads westward of the dangers in this portion of Diligent strait. South Button island may be passed close to on its northern side.†

The CORAL BANKS.—There are three great coral banks on the p. 267. western side of the Andaman group, namely, West Coral bank, 25 miles

* See Admiralty chart, Andaman strait, No. 838; scale = m 1·5 inches

† Originally published in Notice to Mariners, No. 186, of 1889.

in length N.N.E. and S.S.W. and $3\frac{1}{2}$ miles broad; Middle Coral bank 10 miles in length oval shaped, and South Coral bank $8\frac{1}{2}$ miles in length irregularly shaped. They are all composed of dead coral and sand, with here and there single bunches of live coral one to two feet high. They were carefully examined by Commander Carpenter in the *Investigator* in the year 1888, and their shoalest portions sounded over with a water glass in hand. The water is remarkably clear, and with a water glass every detail of the bottom could be discerned. Judging from the appearance of the bottom and the absence of reef building coral it seems probable that the surface débris of the banks is disturbed by the sand of the sea, and that the rollers topple and break on the middle bank in the south-west monsoon, though they may not do so on the other two banks.

West Coral bank lies 15 miles off the west coast of North Andaman, and from its centre, where the shoalest water is 6 fathoms, rocky bottom, the north peak of Saddle Hill bears E. $\frac{1}{4}$ S.

Middle Coral bank, in lat. $12^{\circ} 30' N.$, lying 22 miles N.W. by W. of Spike island, has 23 feet least water, where the rocky strata, which forms the ridge on which these banks stand, just crops up for some 30 yards through the crust of dead coral and sand.

South Coral bank, in lat. $12^{\circ} 15' N.$, lying 14 miles W. $\frac{3}{4}$ N. of Cape Bluff, has 6 fathoms least water on a small brain coral near its centre.

The 100 fathom line passes close to westward of the banks, and the increase of swell will generally give warning of crossing the 20-fathoms line.

In the north-east monsoon they may be safely passed over by vessels of ordinary draught. In 8 fathoms on a calm day the depth looks not more than 20 feet. The navigation inside of the banks to within 3 miles of the shore is quite safe, except on the west side of North Andaman, to which a berth of 5 miles should be given.

Views.—A short description of the distant features of the islands from the vicinity of the coral banks will be useful.

From the centre of West Coral bank, with Saddle peaks bearing East, distant 33 miles, there is no other visible land to be compared with them in height. South of the Saddle the hills fall rapidly to the horizon, above which only a few hummocks are visible as far as Whale mountain, which stands up alone bearing S.E. by E. On a very clear day East Coast hill may be seen a little to the southward. On a nearer approach to land North Reef island and Interview island appear above the horizon, the latter showing a long level topped ridge.

From the Middle bank on a fine day Saddle peak is well above the horizon, but seldom visible. Whale mountain appears whale backed, bearing N.E. by E., and stands alone except for a 700 feet peak east of Interview island, which shows low just to the left of it. To the south of Whale mountain, a high range standing well back, with a sharp peak on the right slope of the highest part, marks East Coast hill. The near range stretching from E. by N. to E.S.E. is the "West Coast" range of Middle Andaman, and where the land falls low at the southern extreme of the range the vicinity of the Middle strait can be recognised.

From the South bank, on a fine day, Whale mountain is the most northern land visible; then comes East Coast peak, still high but very faint; and close to its right West Coast peak and range, which terminates at Spike island, the latter showing from here a small tuft at its northern end. South of Spike island the land continues low, with here and there a small peak until it rises to the high range east of Port Campbell.

ANDAMAN STRAIT — Western Entrance. — Spike p. 269.
island, shaped like a marline spike, and lying north and south, has its broad end to northward. It covers the gap between Middle and South Andaman and the western entrances of Homfray and Middle straits, and forms protection to a large sound. Its summit is at its northern end, from which it slopes gradually to its south point, where there is a deep but dangerous entrance into Middle strait. The western coast of Spike island is faced by a reef and outlying rocks, but the northern side is clear and forms the south side of a good channel into the sound. On the opposite side of the channel there is a rounded knoll, which is one of the south points of Middle Andaman; from this knoll the north side of the channel trends north-westward into two small bays. At the outer northern point are some pyramidal rocks, and from these a ledge, which covers at high water, extends southward towards the channel. A small spit projects off the north-west point of Spike island.*

Directions.—Approaching the north end of Spike island from the westward bring the northern inner entrance point, at the foot of the knoll, to bear E.S.E., and it should be then just touching the north end of Stroat island, an island inside the sound, with a low mangrove north point. Steer in on this till the north-west point of Spike island bears South, when keep in mid-channel, and, turning

* See Admiralty plan Andaman strait, No. 838; scale, $m = 1\frac{1}{2}$ inches.

southwards round Spike island, anchor in 10 to 12 fathoms off a brown cliff about half a mile down its east coast.

From here there are two passages to the east coast for small vessels, forming between them an island, which may be called *Báratán*, from the name of the tribe living on it. A large stream runs into the north end of the sound.

HOMFRAY STRAIT, the northern of the two, is intricate and rocky, but the depths are good until arriving near the eastern entrance, where there is a broad bar of 8 feet, sand and gravel. Outside this again there is a dangerous shoal which nearly closes the reef off Guitar island. The narrowest part of this strait is about 60 yards, and the bamboo grows plentifully on its banks. The tidal stream is weak.

Tala-Kaicha island is the next large island, lying east of Spike island, and two small islands lie off its north-west side, the northern of the two, which has a hill on it, being *Stoat island*; the other is a low mangrove island.

Wales reefs.—Rather more than half way down Spike island, and near the south end of Tala-Kaicha, a large circular coral reef occupies the centre of the sound. South and west of it are two or three other heads. It is generally but not always visible.

DIRECTIONS FOR MIDDLE STRAIT.—After rounding Spike island, north end, haul to southward and keep in mid-channel for 2 miles until abreast of the south end of the low mangrove island. Now borrow on the eastern shore until the apex of a fine peak to northward comes out to the east of the nearer hills. The best channel through Wales reefs is that between a ledge of rocks that only covers at high water, 2 cables N.W. by N. of the south end of Tala-Kaicha and the largest coral reef. The apex of the conical peak above-mentioned kept just showing on a N. $\frac{1}{4}$ E. bearing, clear of the hills which form the western side of the large mangrove valley to northward, leads through between the above dangers, each of which has been marked by a perch. When the south extreme of Tala-Kaicha bears E. by N. haul out to avoid the rocks off the next island and steer S.W. by S. for the south end of Spike island. The deepest water now lies against the west side of the sound, which should be followed down. When the island with two small hillocks on it, which marks the west end of the narrows, bears S.E. by E. stand across for it, and passing to south of it, continue in mid-channel through the straits. At spring tides it would be well to avoid the narrows when the current is at its strongest. The stream is slack in

the narrows at the same time as high or low water at port Blair. At neap tides it is slack all day. (See directions for eastern entrance of strait, pages 36, 37).

NORTH REEF island, 2 miles square, with a bight on its eastern side, is a low flat wooded marshy island, $4\frac{1}{2}$ miles north of Interview island. A reef projects one mile seaward from its north-west point and joins the reef extending $1\frac{1}{2}$ miles off its south point. Close off the north-east point of this island is Austen, a small wooded sandstone island. There is channel between the two, but it is narrowed by a spit off Austen island. p. 268.

There is good anchorage in 10 fathoms in the bight eastward of North Reef island, and a vessel approaching from the north-westward should pass round Austen island at a distance of 4 cables, avoiding a shoal that lies $1\frac{1}{2}$ miles N. by E. of Austen island, and also a spit that extends about 3 cables south from the same island. Nicobar pigeon abound.

Shark islet (formerly named Flat islet), 3 miles off the coast, lies $6\frac{1}{2}$ miles N. by E. $\frac{1}{2}$ E. of North Reef island, and is a small sandy islet standing on a foundation of rock. Its trees are visible 9 miles.

Interview island, 14 miles long north and south, and 3 miles broad, lying between latitudes $12^{\circ} 46'$ and 13° N., is a level topped wooded island, 370 feet high, lying off the strait which separates North and Middle Andaman. The north point is low and rises gradually to the level ridge; the south point terminates in a cliff, close off which a rocky pinnacle 22 feet high stands in the water. The cliff, whenever the sun is to the southward of it, catches the sunlight, and is thus a useful mark. Reefs extend off the north and south points of the island. One mile S.W. by S. of the south cliff there is a small woody islet named South Reef island. From the latter a stony bank of 3 to 5 fathoms extends $3\frac{1}{2}$ miles to the S.S.E. H.M.I.M.S. *Investigator*, in the year 1888, entered the channel east of South Reef island, and anchored near the south point of Interview island, but she passed through muddy water and dangerously irregular soundings indicating rocky bottom. The name of port Andaman is therefore scarcely applicable until this channel has been properly surveyed.

Cape Bluff.—The cliffs of this cape are visible at some distance when the sun is to the westward of the meridian. p. 269.

Port Campbell can be recognised in the afternoon by the yellow terraced cliffs which show up in the sunlight.

Tarmugli island, the most northern of the Labyrinth group, has no specially distinctive features, except its south-west point, which is clifty, with one or two dry rocks off it. A reef fringes its north and west sides, being irregular on its western side with outlying patches, and continuous on its northern side with a large field of foul ground extending 2 miles to the northward and culminating in Allen patches, which are only separated from the shoal water off Palmer's point by a narrow channel of clear water.

Allen patches have one head of coral, awash at low water springs, which lies 7 cables from their north end.

Currents.—On the west side of these islands in the fine season the surface current runs to the southward for days together, but it occasionally reverses for 24 hours.

p. 269.

Omit lines 31—36, the remarks of Dr. Mouat.

p. 270.

Port Mouat.—A coral head named Helby rock, having only 12 feet water, lies in the centre of the channel between Perseus and Andromeda points.*

Directions.—Keeping in not less than 20 fathoms bring Perseus point to bear E. by S., and steer for it on that bearing. This will lead between the shoal ground off Palmer point and the north end of Allen patches until Grub island (small, with a high yellow cliff) bears S.S.E. in line with mount Foord on Rutland island. Steer with these objects in line, which will lead between Allen and Hooper patches, until the northern inner entrance point of port Mouat bears E. $\frac{1}{4}$ N., when steer for the point and pass southward of Helby rock.

Constance bay, formed by Palmer point, is a shoal bay 4 miles north of port Mouat, and has several islets and reefs. A large dry rock lies on the south edge of the reef off Palmer point, and a spit of 3 to 8 fathoms extends 2 miles S.S.W. of the rock.

* See Admiralty chart, port Mouat, No. 898 ; scale, $m = 4$ inches.

CHAPTER VIII.

Variation $2\frac{3}{4}$ Easterly.

BASSEIN RIVER.—Wolf rock is now marked by a tripod p. 277.
beacon, 16 feet high, painted red with cage. It should not be
approached from the eastward within a distance of 3 cables.*

Long Sand is an island with trees on it.

Coal.—About 1,000 tons are usually kept in stock at Bassein. p. 279.
It is inconvenient for coaling except for vessels going up the river.

IRRAWADDY RIVER approach.—**Baragua flats.**—It p. 281.
was reported in the latter end of the year 1888 that the outer edge of
Baragua flats had extended to the southward since the date of the
last survey.† In April 1889, however, the Indian Marine steamer
Enterprise examined the southern edge of the flats and found that
the depths as shown on the present Admiralty chart had not altered.

It is remarked in the Bay of Bengal Pilot, p. 283, par. 1, that in p. 283.
rounding Baragua flats, mariners should study the time of high and
low water. They should also bear in mind that high water, full and
change, at Alguada reef, occurs at about 10:30, and at China Bakir
lighthouse (140 miles distant) at 1:45: due allowance should therefore
be made for the turn of the stream. Captain Worcester, of the P. & O.
steamship *Siam*, states that in the months of October and November
a steady set to the westward, overcoming the flood tide, has
occasionally been experienced. Much caution is therefore requisite.
Constant sounding and the use of the ground log is again enjoined.‡

Erratum, line 24 from top. *For* do not shoal less than 10 fathoms,
read do not shoal less than 8 or $8\frac{1}{2}$ fathoms at high water.

Fairway buoy has been moved S. 18° W. $1\frac{1}{2}$ miles, and now lies pp. 285,
in 21 feet on the following bearings—China Bakir lighthouse 291.
W. $\frac{1}{2}$ S.; Lower Western buoy N.N.W.

RANGOON RIVER.—**Pilot vessel.**—**Signal lights.**—The pp. 285
following alterations have been made in the lights shown by the 286.
pilot vessel at the entrance of Rangoon river :—

* See Admiralty chart, Bassein river, No. 834; scale, $m = \frac{1}{4}$ inch.

† Originally published in Notice to Mariners, No. 58, of 1889.

‡ See Admiralty chart, Koronge island to White point, No. 823.

1. The pilot vessel, when at anchor on her station on pilotage duty, will carry a *white* light at the starboard fore-yardarm, visible all round the horizon from a distance of at least one mile ; and will also exhibit a flare-up light or flare-up lights at short intervals, which will never exceed fifteen minutes.

2. The pilot vessel, when under way, and engaged on her station on pilotage duty, will carry a *white* light at the main-topgallant-masthead, visible all round the horizon, and will also exhibit a flare-up light or flare-up lights at short intervals, which will never exceed fifteen minutes.

3. The pilot vessel, when not engaged on her station on pilotage duty, will carry lights similar to those of other ships.*

p. 287.

TIDAL signals.—On King point there is a tidal semaphore showing the rise of tide above low water springs, as follows :—

0	1	2	3	4	5 FEET
6	7	8	9	10	11 FEET
12	13	14	15	16	17 FEET
18	19	20	21	22	23 FEET

As seen coming from the southward.

In Rangoon reach the signals will show the reverse way.

* Originally published in Notice to Mariners, No. 18 of 1889.

Light vessel.—In the year 1887 a light vessel (named the *Colombo*) was placed in the fair-way of the entrance of Rangoon river to the E.S.E. of Elephant point. Consequent on the Spit sand having encroached into the channel from Western Lump buoy to below Centre Spit buoy, this light vessel was shifted in November 1888 about $2\frac{1}{4}$ cables in a direct line towards Eastern Grove light-house, and then lay with the obelisk on Elephant point bearing N.W. by W. $\frac{3}{4}$ W. distant $2\frac{3}{10}$ miles.* pp. 287, 289, 291.

[NOTE.—Owing to the power of this light being small, the riding light makes it appear that the light vessel carries two horizontal lights, instead of one *fixed* light.]

Eastern Lump buoy (now named Lower ridge) was also moved to a position $2\frac{1}{2}$ cables N. by E. $\frac{1}{4}$ E. from the light vessel; and Centre Spit buoy was moved nearly 3 cables S. by E. $\frac{1}{2}$ E. from its former position.

Caution.—The changes in the depths and in the position of the banks in Rangoon river and its entrance are so frequent that the chart can never be taken as a sure guide. The buoys and light-vessel are moved as necessary to mark the channels. pp. 287, 291.

Coal.—Upwards of 12,000 tons of coal are kept in store; vessels are coaled at the rate of 500 tons a day. Vessels are coaled by boats, but could be coaled from the wharves if required. p. 293.

At Brooking wharf there is at low water springs a depth of 24 feet; at Phayre Street wharf 20 feet; at Sooling Pagoda wharf 15 feet; at Latter Street wharf 19 feet. These wharves belong to the port Commissioners.

Repairs.—Engines of 1,200 I.H.P. can be repaired, cylinders of 60 inches diameter bored, and shafts 14 inches in diameter and 30 feet long forged.

Buoys.—Eastern lump buoy has been re-named and is now known as Lower ridge; the former Lower Middle bank buoy is now named Upper ridge. p. 289.

Middle bank is at present marked by three buoys, named respectively Lower Middle, Centre Middle, and Upper Middle..

Choki lumps.—The Port Officer of Rangoon reports that, after a careful examination of Choki lumps, there are not less than 14 to

* Originally published in Notice to Mariners, No. 400 of 1888. See Admiralty charts:—Irrawaddy river, sheet 1, No. 2135; Rangoon river and approaches, No. 833.

15 feet of water in the channel eastward of the lumps, close to the eastern bank of the river.*

Choki Lumps has extended to the westward ; a black conical buoy has been moored W. by N. 3 cables from the buoy on the south side of the Lumps.

p. 307. **MOULMEIN—Directions.**—Commander Carpenter remarks that vessels approaching Amherst point from the south-west will find a swatch of about 14 fathoms, with 11 fathoms on either side of it, lying near the western limit of visibility of Double island light.

p. 308. The resources of Moulmein for undertaking repairs to vessels or engines are small ; there are no works capable of undertaking heavier repairs than could be effected by any of H.M. ships.

The docks are silted up and unserviceable, but the gridiron is said to be capable of receiving vessels of 300 tons.

There are no steam tugs at Moulmein.

p. 309. **Kalegauk island** sighted from the westward and seen against the high land at the back appears low like a flat foreshore to the higher hills. When off this island, Tsheng Taung, near Amherst, shows up like an island off the coast, and is thus an useful mark.

Coal.—A supply of 22,000 tons is kept in stock at Moulmein, and is put on board at the rate of 300 tons a day.

p. 310. **Soundings.**—In lat. 15° N. the 20-fathoms line of soundings, in consequence of changes recently discovered, now extends to long. 96° 50' E.

YÉ RIVER—Approaches.—Four and a half miles north of the mouth of Yé river the high land touches the coast and the summit 1,540 feet is thickly wooded. Here the shore is steep and rocky ; a small creek lies on the south side of this high land, and thence to Pagoda point extends a sandy beach fringed with jungle.†

Pagoda point, rising abruptly from the beach, forms the north entrance point of Yé river, and is a conspicuous hillock, 150 feet high surmounted by a small pagoda. Sidaw Taung, a bold headland 580 feet high, forms the south entrance point. From the west and north-west it is comparatively flat topped, but from the south it appears conical.

* Originally published in Notice to Mariners, No. 18, of 1888.

† The following remarks and directions for Yé river and approaches are the result of a survey made by the officers of the Marine Survey of India, 1887.

South of Sidaw Taung for a distance of 9 miles the coast is low and sandy with small headlands here and there, but the high ranges at the back give it the appearance of being steep.

At 9 miles from Sidaw Taung the high land closes the coast and the headlands become larger until White point is reached, which is 19 miles south of the river. North and South peaks, 2,500 feet high and $1\frac{3}{4}$ miles apart, lie about 7 miles to northward of White point and $3\frac{1}{2}$ miles inland, but as there are other peaks of nearly the same height they are not readily distinguishable.

OFF-LYING ISLANDS.—**Aye island**, $7\frac{1}{2}$ miles north of the entrance of Yé river and half a mile off shore, is 490 feet high, with steep sides and thickly wooded.* p. 311.

TOBY ROCK, lying 6 cables from the shore, $3\frac{1}{2}$ miles N.N.W. of Stag island, is a rocky ledge 3 cables long, which nearly covers at high water and has 6 to 7 fathoms round it.

Stag island.—The northernmost of the main group, lying off the mouth of the river, is a mile long north and south and half a mile broad, with two summits, the northern being 444 feet high. Its western side is steep, but on its eastern side there is a beach, where fresh water can be obtained. A spit extends three-quarters of a mile off the north point of the island.

Nat-gyun, 153 feet, and Bath Bun, 444 feet high, are two small islands lying south of Stag island, and separated from it by a deep channel, which however is not recommended. They stand on a ridge of hard sand which extends nearly down to Pig islands and which dries at very low spring tides.

A small group of rocks awash at high water lies 2 cables N.N.W. of Nat-gyun. Three cables south-west of the west extreme of Bath Bun island is Ghorparay rock, awash at low water.

Depths of 7 to 8 fathoms, even bottom, sand and mud, are found one mile west of the ridge on which these islands stand.

Kyetike-gyun, a low wooded islet with trees 70 to 80 feet high, lies $1\frac{1}{4}$ miles E.S.E. of Bath Bun island, and stands between two shoals in the inner channel to be described presently.

PIG ISLAND.—Two and a half miles long north and south, and greatest breadth half a mile, has the appearance of four islets.

* See Admiralty chart:—Bay of Bengal, east coast, sheet 3, No. 823; Approaches to Yé river, No. 1272;

It consists of four distinct wooded hills connected by low sandy beaches, the southernmost and largest being 530 feet high, steep on its eastern side. Shallow sands extend off its western side for $1\frac{1}{2}$ miles, and a shoal ridge 5 miles long, on which the sea incessantly breaks, lies immediately S.W. of it. This shoal also trends north and south and its southern extreme is $4\frac{3}{4}$ miles south of Pig island. Deep water exists immediately east of Pig island and across to the mainland forming a good channel and secure anchorage.

TAMARIND ISLAND, lying $1\frac{1}{2}$ miles off shore and $4\frac{1}{2}$ miles S.S.E. of Pig island, is 260 feet high, and is a small triangular-shaped islet. The deep channel passes close to the westward of it.

HOARE ISLAND, lying $3\frac{1}{2}$ miles further to S.S.E., is another somewhat similar but lower islet.

OFF-LYING SHOALS.—**Livermore shoal** is a ridge of sand $2\frac{1}{2}$ miles long north and south, having not less than 3 fathoms on it at low water. Its centre lies $3\frac{1}{4}$ miles W. by N. of Stag island, and the 10-fathoms line passes close outside of it. Pagoda point seen clear of north end of Stag island bearing S.E. by E. $\frac{3}{4}$ E. leads to the northward of this shoal and the west extreme of Aye island bearing N.N.E. leads clear on the seaward side, but the lead is the best guide for vessels passing up and down the coast, and not less than 12 fathoms should be obtained in its vicinity.

ROSS SAND, $6\frac{1}{2}$ miles from the coast and believed to be the outer danger off White point, is 6 miles long in a north and south direction, and has its northern extreme almost overlapping the long shoal off the south-west end of Pig island. Its north end is the shallowest part having only $1\frac{1}{2}$ fathoms hard sand, whilst the general depth is 4 fathoms on the ridge, with a lump of 3 fathoms near the south end. It is barely a mile in breadth anywhere, is steepest on its eastern side, and is generally discernible by discolouration and tide rips. No directions can be given for clearing the sand and the lead is of little use. Bearings of Stag island, Moskos islands, and North and South peaks will be useful for ascertaining position.

From the above remarks it will be seen that a chain of islands and shoal ridges extends for about 21 miles parallel to the coast with no passages between them that can be recommended.

Inside this chain are a few rocks and shoals, the latter chiefly caused by the silt from Yé river. These will now be described.

PASCOE BANK, lying immediately off the bar of the river, is a narrow shoal of sand 2 miles long north and south. Its north end lies one mile S.W. by W. from Pagoda point, and its south extreme is a little south of Kyetike-gyun. The safe channel is between this shoal and the bar; and a useful leading mark, Aye island kept just touching the mainland, leads through it. The centre of this shoal dries at low water springs when there is not less than 4 fathoms in the channel.

SIMPSON SHOAL, trending south for $2\frac{3}{4}$ miles from Kyetike island, is similar in shape to Pascoe bank and has a least depth of one fathom, sand and mud, near its centre. Its south end is 6 miles S. by E. of the north end of Stag island, leaving a channel half a mile wide between it (Simpson bank) and the end of the long bank extending south from Bath Bun island. This channel can be used by keeping Bath Bun and Stag island just touching; but a stranger would probably prefer that east of Pascoe bank. The east side of Simpson bank is cleared by keeping Kyetike islet showing to the left of the high land over the coast to the northward.

Tides.—It is high water, full and change, at Stag island a 11h. 55m. Springs rise 18 feet, neaps rise 12 feet. The lowest tides are in February and March. Inside the bar high water is nearly at the same time as outside, but the times of low water differ considerably, the escape of water at the bar being checked by the sands so that the tide outside commences to rise some time before that inside. Owing to this check the level of the water inside the bar at springs never falls so low as that outside. When allowing for the rise of tide above the soundings on the chart it must be borne in mind that there is 3 feet less rise on the bar than there is outside. Owing to this, although neaps are stated to rise 12 feet at Stag island, they only rise 9 feet on the bar; and with minimum range only $7\frac{1}{2}$ feet. As the bar nearly dries this limits the entrance, at ordinary high water, to vessels of less than 7 feet (*see* page 51).

Tidal streams.—The flood tide sets along the coast to the northward, running about 3 knots at springs. The ebb sets in a similar manner to the southward. At springs the water is much discoloured outside the islands.

Anchorage.—There is good anchorage for large vessels east of Stag island, and also east of Pascoe bank, anchoring on the leading mark, Aye island just touching the mainland, and Kyetike islet bearing S.W. by S. $\frac{1}{2}$ S. To the southward there is good anchorage east of Pig island.

Directions.—Approaching from northward Kalegawk island will probably have been sighted, after which Aye island under the high land, and Stag island further out, will have been seen. On approaching Stag island on a S.E. by S. course which leads $1\frac{1}{2}$ miles from Aye island, Pagoda point will be recognised as a hummock at the end of a level stretch of beach. Bring it to bear S.E. $\frac{3}{4}$ E., when it will be on with the western slope of Sidaw Taung and in line with a dip in the distant high land. See View on chart, No. 1272. This course keeps clear of the spit off the north end of Stag island and leads on to the next line, namely, Aye island touching the mainland bearing N.N.W. westerly, by following which anchorage can be had either east of Stag island, or if intending to take in cargo, east of Pascoe bank.

Approaching from southward.—Pass inside Ross sand, which is generally visible by discolouration and tide ripples, with Pig island bearing North until Tamarind island bears N.E. or South peak E. $\frac{1}{2}$ N. Then steer to pass one mile west of Tamarind island, and midway between Pig island and the mainland until Pagoda point is seen bearing North in line with a notched peak a short distance behind it. This course leads east of Simpson bank and brings the vessel to a position off the bar if necessary east of Pascoe bank.

To pass out to sea north of Ross sand, bring Tamarind island to bear N.E. by E. and the high land north of Stag island to show over the west extreme of Pig island bearing N. $\frac{1}{2}$ E. From this position steer out N.W. by N., allowing for tide, the channel being 2 miles wide. It is well to remember that Tamarind island is the northern of the two islets lying close off the coast between Pig island and White point.

YÉ RIVER, which enters the sea between Pagoda point and Sidaw Taung, is said to have its source beyond the British frontier in Siam, and after passing through the hills east of Yé district flows through a cultivated land past Yé town, after which it follows a very twisted course to the sea, breaking into two branches about half way, which join again near the mouth and form a large island between them. Owing to its sharp turns there are numerous sands which are difficult to avoid and it is only navigable for short vessels drawing less than 7 feet.

Bar marks.—The western mark, a double-ended cone on a pole near the fishing stakes 6 cables north-east of Sidaw point. The

eastern mark, a white globe in a tree at the edge of the mangroves north-east of Sidaw point. These marks are used for the outer part of the bar.

For the inner part of the bar there stands in a tree a little distance north of eastern mark a triangle and diamond painted red.

On the bluff, the west extreme of the hill Sidaw Taung, on the south side of the entrance, are two white balls, one on a pole on an outlying rock off the bluff, and the other on a tree on the east end of the same bluff.

At the mouth of the creek, Oagi Chaung, is a white ball in a tree, used for clearing the sands when clear of the bar and heading up the river.

To cross the bar.—We may presume that high water would naturally be chosen for doing this both for increased depth on the bar and so as not to carry a strong flood up the river which would be fatal to steering round its sudden bends.

At high water neaps, as already stated, not more than $7\frac{1}{2}$ feet of water can be depended on, but within a day or two of spring tides 12 feet can always be got at high water in the channel.

With the left extreme of the bluff under Sidaw Taung bearing N.E. by E. the eastern and western marks will be made out a little to the left of it. Keeping the eastern mark (*see* description) just open to the right of the western mark steer in until the bend of the beach, one mile north of Pagoda point, is nearly shut in by that point, when steer one point to the northward to bring the two globes on the near bluff of Sidaw in line with one another E.N.E.; when in line steer over for them until western mark comes on with the Triangle and Diamond in the trees to the north of eastern mark. Now steer with these new leading marks in line until the extreme of the bluff bears South when keep a little to the northward again, bringing western mark *between* the marks to the eastward in the trees. This leads the vessel in until the next reach of the river opens up to the northward. Asun Pagoda, a conspicuous object on the proper right bank, will now open clear of Zibuthung point, which is the inner extreme of the entrance on the north side. Keeping it well open to avoid a steep sand running S. by E. from Zibuthung point steer to pass the latter point at half a cable distant. Oagi-Chaung mark bearing N. by W. $\frac{1}{2}$ W. in line with Asun hill also leads up this reach.

The river here divides into two branches, the one to the northward past the pagoda being quite shallow when examined in 1887, the

other, Zibuthung reach, which will be seen opening to the N.E. is comparatively straight, and leads, by somewhat intricate navigation, to the town of Yé.

Tides.—Inside the bar of the river it is high water, full and change, at 12h.; springs rise 15 feet, neaps rise $8\frac{1}{2}$ feet. At Yé town it is high water, full and change, at 1h. 08m. approximate; springs rise 13 feet, neaps rise $6\frac{1}{2}$ feet.

Over the bar and inside the river the first of the flood sets in the line of the channels, but when the sands are covered and at neaps, when they do not uncover, it sets for Zibuthung point. The ebb acts similarly in a contrary direction and tends to set a vessel coming down the last reach on to the sands south of Zibuthung point. It is very strong in the channels after the sands are uncovered and off Sidaw point runs 4 knots.

In the upper reaches the tide ebbs and flows in the direction of the channels, eddies being met with under the lee of the bends. At Yé the floods runs up for about 5 hours.

Climate.—Fine weather prevails from middle of November to middle of March. Northerly and easterly winds prevail during the day, and westerly breezes in the afternoon during February and March.

During February the weather is frequently hazy for several days, distant objects obscured. The rainy season does not end till 15th November, and up to that date fever is prevalent. The temperature near the mouth of the river ranges from 80° to 90° at midday between November and March, and 60° to 70° in the early morning.

Yé, lying $7\frac{1}{2}$ miles up a river of the same name, is the capital of Yé district which is situated between Amherst and Tavoy in the province of Tenasserim. The range of hills on the south side of the river entrance forms a boundary between Yé and Tavoy districts.

The town stands on the north bank of the river on high ground and its pagodas are conspicuous for many miles.

Trade consists chiefly in the import of tobacco, cotton and silk piece goods, earthenware and porcelain; and export of paddy, salt, dunnies, sessamum and boats' hulls.

Population of Yé town is 3,350, and for the whole district 16,466.

Supplies.—Rice, fish and vegetables are easily obtainable, but not coal, wood being used as fuel by the trading steamer, a supply of which she obtains at Yé.

There are two piers built of wood, but the foundations of the older one having sunk it is rendered almost useless. Vessels of 7 feet

draught only can reach the town at neap tides, vessels of 12 to 14 feet draught could reach the town at spring tides.

Communication.—There is telegraphic and postal communication, and a steamer runs to Moulmein and Tavoy monthly.

Mount Nabulé.—The high mountain in lat. $14^{\circ} 23'$ N. is named p. 312. Nabulé, and is 3,805 feet high. It shows as a fine peak when seen from the northward or southward, but blunt when seen from the westward.

HEINZÉ (Hinzé) basin.—From White point a bold rocky coast trends S.S.E. for $11\frac{1}{2}$ miles to Hinzé basin, the entrance point of which is named Dolphin's nose. From the nose shoal water extends S.W. by S. 6 miles, the sands drying out at low water springs for $2\frac{1}{2}$ miles, covered by 2 or 3 feet water for another mile, and then deepening to $4\frac{1}{2}$ fathoms. Vessels approaching from the southward should not approach within a distance of 7 miles from the shore, but if desirous of communicating with the basin by boat, the shore north-eastward of northern Moskos island can be approached nearer; or by steering for Dolphin's nose, bearing between E. by N. and E. by S., anchorage may be obtained in $4\frac{1}{2}$ fathoms at $1\frac{1}{4}$ miles distant from the nose.

Hinzé basin is about 20 miles long north and south, with the main entrance nearly equidistant from the extremes of the lake.* The width of the basin is one to 3 miles, and the depth 2 to 6 fathoms. The entrance between hills 700 feet high is about a mile wide in the narrows, and is over 8 fathoms deep in parts; but two rocky heads show at low water on the north side of the narrows, and there may be more such dangers. Outside, the sands are an effectual bar, and nothing is known of the channels between them. A boat may enter at high water from the anchorage off Dolphin's nose by steering for the bluff on the north side of the narrows bearing East; this will lead across a narrow sand 6 cables south of the nose, after which she may follow the shore until inside the basin. High water inside the basin appeared to be half an hour later than that outside. The tidal streams run with great strength in the entrance. A great quantity of foliage is swept out by the ebb.

Moskos islands.—Vessels by day passing up and down inside Moskos islands pass eastward of North ledge, being warned of approach to Hinzé banks by the lead. North ledge is about 3 feet high, it has no rocky heads round it.

* There are, it is believed, two other outlets, both quite shallow, and probably closed in the dry season.

CHAPTER IX.

[Variation $2\frac{3}{4}^{\circ}$ Easterly.]

MERGUI ARCHIPELAGO.

- p. 320. **Weather.—Climate.**—The finest weather is from November to February when the north-east monsoon is blowing in the China sea. Owing probably to the narrowing of the Malay peninsula the N.E. breezes are stronger in the neighbourhood of Pakchan, and near High island the breeze is often strong in the middle of the day. At that time of the year too the air is clear and all distant peaks are visible making navigation easy. The nights are cold, the thermometer sometimes falling to 65° , and occasionally the N.E. wind freshens between 10 P.M. and 2 A.M.

Towards the end of February and in March the weather becomes misty and calm with increasing heat, and the winds tend to N.W.

- p. 325. **Mergui harbour.**—Omit the footnote at page 325. The white-washed pagoda used as a leading mark is small and difficult to see unless whitewashed. The conspicuous pagoda is the one near the Commissioner's house on the west face of the hill overlooking the river.*

- p. 332. **DIRECTIONS.**—With the exception of the vicinity of West Passage island there is, as far as is at present known, deep water between Christmas island and Forest's strait, but as the channels have only been partially examined caution is requisite and the lead should be kept going. After passing one mile west of Christmas island steer S. $\frac{1}{2}$ E. for $10\frac{1}{2}$ miles so as to pass from 2 to 3 cables east of West Passage island. This course leads $2\frac{1}{4}$ miles east of Warning rock and $2\frac{3}{4}$ miles west of another sunken reef in the same latitude, and care must be taken to allow for the tides which here set N.E. and S.W., the lead being of little use owing to the depth. When passing West Passage island if the water shoals dangerously keep more to the westward where it is deepest; pass South Passage island at three-quarters of a mile. Then steer S. $\frac{1}{2}$ W. to pass the south-east point of Bentinck island at one mile distant, after which bring that point to touch the west side of South Passage island, N. $\frac{1}{4}$ E. From here Bushby island, High Peaked island, and the Five Sister group become visible. [The above supersedes the par. 4 (directions) page 332.]

* See Admiralty chart, Northern part of Mergui archipelago, No. 216a.

Keep Bluff point (Bentinck island) touching South Passage p. 332. island (which leads one mile westward of Fly rock) until past that danger, and then steer a middle course between the rocks off the Five Sister group and the conical rock off Bushby island, after which steer S.S.E. $\frac{3}{4}$ E. to pass 3 miles east of Father and Son, and $2\frac{1}{2}$ miles west of High island. Care must be taken to allow for the tidal streams near Bushby island which are strong. If passing Fly rock on passage north keep the Father and Son well open of the conical rock off Bushby, or the whole of the conical rock open West of Bushby island will also clear it, South Passage island being difficult to distinguish when approached from the southward. There is deep water marked on the chart east of Fly rock, but the usual track leads to westward of it and should be followed.

FORRESTS STRAIT.—Directions.—Forrests strait is used p. 336. by all steamers and native vessels trading through the Archipelago, there being plenty of water and good shelter from westerly winds. With the aid of Admiralty chart No. 216a it can be traversed without difficulty. The attention of the mariner is here called to the advisability of taking bearings to summits marked on the chart and not to extremes of land which are affected by distance, mirage, and new growth of foliage. Although the strait (in the track now to be described) is navigated by night by those well acquainted with the aspect of the land, &c., it is not advisable for a stranger to do so owing to the difficulty of making the channel between Marble patch and Campbell reef.

The same course of S.S.E. $\frac{3}{4}$ E., allowing for set which has been pursued since passing Bushby island, will lead to a position $3\frac{1}{2}$ miles S.W. of Canister rock, whence course should be altered to S. by E. $\frac{1}{2}$ E. for Turret island, visible 17 miles, a bold precipitous rock, which will be seen, if the weather be clear, standing out from the land like a square block. Keeping on this line, which leads in mid-channel between the Gregorys and the main coast, the depths will gradually shoal to 5 and $3\frac{1}{2}$ fathoms at low water. The narrowest part of this channel is between the rocks off Red point (which is no longer red) and Kurrachee rock; but even here the channel is nearly 4 miles wide, and by keeping in less than 10 fathoms Kurrachee rock will be avoided. It should be remembered that Campbell reef covers at high water. When the south end of the largest Gregory bears W. by N. $\frac{1}{2}$ N. haul out to S.S.W. into deep water, whence a southerly course will take the vessel 2 or 3 miles eastward of the Five islands,

when steer S by W. or perhaps more westerly, to avoid the extensive flat of sand and mud lying off the entrance of Pakchan river.

Vessels proceeding to the northward may avoid Kurrachee rock by bringing the smaller Turret island (188 feet) to shut behind the larger one (340 feet) bearing S. by E. $\frac{1}{2}$ E. until past the danger. Anchorage is good anywhere between High island and Turret island.

The channel westward of the Gregory group although deeper has irregular soundings and is impracticable by night ; by day it should not be navigated without a large scale plan of the strait.

p. 332.

The GREGORYS.—Off the south end of Sullivan island and in the middle of the strait are the Gregorys, five low level tree islands on flat rocky bases covered with sand. The northernmost (Crichton or Bogwo) is 18 miles S. by E. from High island and is a mere wooded cay. From it, shoal water extends $1\frac{1}{2}$ miles to the northward, terminating in a coral patch of 4 feet called Marble patch.* Ordinary care should keep a vessel clear of this patch, as it is in neither channel. Boyut, the Southern Gregory, has a shoal ridge extending to S.W. of it, and should not be approached from any direction within $1\frac{1}{2}$ miles. All the islands of this group have rocky ledges projecting from them and no attempt should be made to pass between them. They are uninhabited but are visited by wood-cutters. The Nicobar pigeon has made a home there, also flying foxes, tree crabs, and the Monitor lizard.

Tides.—It is high water, full and change, at the Gregorys at 10h. 20m. Springs rise 14 feet ; neaps rise 10 feet. In the winter night tides are higher than day tides. In the summer months when there is more water in the bay of Bengal the tides do not fall so low as in the winter.

Tidal streams.—Near High island the flood and ebb run nearly East and West.

In the channels on either side of the Gregorys flood sets to N.N.E., ebb sets to S.S.W.

p. 333.

KURRACHEE ROCK dries 5 feet at springs, and can be avoided by keeping in soundings of less than 10 fathoms to eastward. The rock with less than 6 feet on it, said to lie S. by W. $\frac{1}{4}$ W. nearly one mile from Kurrachee rock, was not found during the survey.

The eastern side of Forests strait is formed by the main coast of Tenasserim, which although high some distance inland is, near the

* Marble rock, reported to lie with northern Gregory island bearing S.S.E. $\frac{1}{4}$ E., distant $2\frac{1}{2}$ miles, was searched for without success, drags being extensively used. It has consequently been removed from the Admiralty charts.

shore, low and without any conspicuous marks. Boyce hill (812 feet) will, however, be known by its being the only hill near the shore. A mud bank lies off this shore and close in there are several rocks showing at low water. Off the north end of the Boyce headland, called by the Burmese Kanmau, are several small islets.

Canister rock, the northern of these, is 87 feet high, but small with steep sides, and it is $12\frac{1}{2}$ miles from High island. A rock dries 4 feet at low water springs a quarter of a mile North of it.

Campbell reef, 2 cables long by $1\frac{1}{2}$ cables wide, is a flat stony reef that covers at high water. It lies $3\frac{1}{2}$ miles S. $\frac{1}{4}$ E. from Canister rock and forms the north-eastern danger of Forests strait. Vessels running South at night are liable to come near it before they are aware, depths of 6 fathoms being carried to within a mile of it, and being flat it is difficult to distinguish.

Boyce shoal, reported to be about 2 miles east of the Gregory group, opposite Boyce hill, was not found when the strait was surveyed in 1886. Its existence seems doubtful. It was said to have 12 feet of water over it at low water tide, and to have depths of 5 to 8 fathoms close round it.

BENTINCK ISLAND (Baza-ngu), north point in lat. $11^{\circ} 52' N$. p. 334. The whole island is hilly and there are many high summits, but the most conspicuous is a summit 1,018 feet high near its northern end, which shows like a horn when seen on a north-easterly or south-westerly bearing. The north-east arm of Bentinck island is really a separate island, having a narrow gut of water about 2 fathoms deep separating it from the main island and leading through into the northern bay which has been only partly examined.

The western coast of Bentinck is steep and iron bound with several islets off it; but on the east coast, which is much indented, there is smooth water and good anchorage especially between the Passage islands. Daphne shoal lies about 4 miles to the northward from the south extreme of the east coast and one mile E. $\frac{3}{4}$ S. from the mouth of a small creek. Several rocks, one of which is perforated, lie off the south end of Bentinck island, the southern of which is about 10 feet high and lies $2\frac{1}{2}$ miles S.W. by W. from the south-east point. p. 335.

West Passage island and **South Passage island**, on the north-east side of Bentinck island, are 445 and 364 feet high respectively; bold wooded islands with their ridges trending N.E. and S.W. They are both steep-to on their eastern sides and

foul off their western sides. The northern of the two, named West Passage island, marks the western side of the channel leading south from Christmas island.

Dangers.—Warning rock.—Several dangerous rocks lie north-westward of West Passage island; of these, Warning rock is the nearest to the beaten track and bears N.N.W. $\frac{1}{2}$ W. distant $4\frac{3}{4}$ miles from the east point of that island.

Peterson rock dries 6 feet at low water springs, and bears W.N.W. one mile distant from the east point of West Passage island.*

Elephant island, comparatively low, (140 feet) appears flat topped from a distance but is really very peculiarly shaped. It marks the eastern side of the channel. A single rock, Cap and Feathers, 34 feet high, stands half a mile N.W. of it and must be given a berth of at least 3 cables.

p. 335.

HIGH PEAKED ISLAND, 960 feet, shows up well from the northward and north-westward, being conical from that direction. Another conical peak, two hundred feet lower on the south-west point of Domel island, shows to eastward of it. Off the north end of High Peaked island is a cliffy islet, and two rocks. The northernmost rock is 40 feet high and is called Fly island to distinguish it from Fly rock, a sunken danger to be described presently.

Fly rock, a dangerous pinnacle, which is just awash at low water spring tides, and is only a few yards in extent, is composed of rock covered with an encrusting coral. It is perfectly steep-to on all sides, and cannot be seen at ordinary low water. From it, the west extreme of Bushby island bears South distant 6 miles; the south-east point of Bentinck island, N. $\frac{1}{2}$ W. and Fly island, S.E. by E.

p. 335.

BUSHBY ISLAND (Buza) is bold having many similar wooded summits about 900 to 1,000 feet high. Its north coast is indented and has a village in one of its bays. A good watering place will be found at a small sandy cove at the north-west point of Bushby island, anchorage being available in 8 fathoms just outside a line joining the points of the cove. Many wild pigs were seen at the stream. A conical islet or rock 200 feet high lies close off its western coast.

The Five Sister Group, consisting of five small islands and about fifteen rocks of various sizes are mostly bare and are probably uninhabited. The rocks on the east side of the group are not easily seen in the dusk, one of them being only 10 feet high.

* Originally published in Notice to Mariners, No. 38 of 1887.

FORRESTS strait.—High island, 1,400 feet, a lofty double peak, is easily recognised from northward or southward as it stands alone. The track lies 2 miles west of it (where there are overfalls and eddies probably made by the tide over an irregular bottom) and passes through discoloured patches. A rocky ledge dries out 2 cables from the large sandy beach on its east side, and to the northward of this there is a cove where fresh water can be obtained; but a kedge is required for anchoring close in as the depth is over 15 fathoms. p. 336.

The shoal reported as lying with High island bearing about S.S.W., distant about 3 miles, was searched for without success. Overfalls and tide rips were however numerous northward of the island. This shoal has been removed from the Admiralty charts. See page 53 of this supplement for directions.

Sullivan or Lampi island.—Sullivan East Foreland has a low white cliff on it which shows up in the morning sun. Another bold promontory projects $2\frac{1}{2}$ miles south of East Foreland, but is not so conspicuous. At the north end of Sullivan island, but close to it, are several small islands; Two Hill island and Olive island appear to have deep water off them, but the Dolphin islands, which are low, with conspicuous trees upon them, have a bank extending $1\frac{1}{2}$ miles east of their southern extreme. p. 336.

There are also several islands off the west side of Sullivan island sheltering an anchorage where vessels can ride in 6 to 4 fathoms, but it is not much visited and has only been partially examined. There is an excellent stream of fresh water here at all times of the year. A large white rock is in front of the watering place. A pearl bank of some extent has been reported off this side of the island.

HALF MOON SHOAL, lying $3\frac{1}{2}$ miles N. $\frac{1}{2}$ W. from the extreme of East Foreland, is a reef, awash at low water springs, and is about 2 cables in extent lying $1\frac{1}{2}$ miles off shore. The summit of Olive island open East of the Dolphins, leads to north-eastward; and the bold promontory seen outside the Foreland leads to the south-eastward. p. 337.

Off the south end of Sullivan island are Eyles island, 774 feet and Steep island 426 feet; and $1\frac{1}{4}$ miles East of the latter is Steep shoal, a narrow rocky shoal of 5 feet at low water which can be avoided by keeping High island summit open to the right of the Foreland, bearing N. $\frac{1}{4}$ W. p. 336.

A LIST
OF
ALTERATIONS AND ADDITIONS TO LIGHTS.

(Corrected to 31st December, 1889)

EMBRACED BY
BAY OF BENGAL PILOT,
1887.

Page in the pilot.	No. in the light list.	Name of light.	Position.	Latitude. N.	Longitude. E.	Number and colour of lights.	Character of light.	Interval of revolution or flash.	Miles seen in clear weather.
39	163a	BARBERYN ISLAND.	- - - -	6 28	79 58	1	White.	Fl. One minute.	- -
61	166	LITTLE BASSES.	On reef.	6 25	81 44	1	White.	Fl. One minute.	16
55	164a	DONDRA HEAD.	- - - -	5 55	80 35	1	White.	Fl. Twenty seconds.	- -
72	168	TRINCOMALI BAY—FOUL POINT.	Near extreme.	8 32	81 19	1	White, with flash.	F. & Fl. Half minute.	17
103	- -	CUDDALORE.	On mound.	11 43	79 46	1	Red.	F. - -	5
107	182a	MAHABALIPUR PAGODAS.	Conspicuous rock about 6 miles northward of Sadras.	12 37	80 11	1	Red.	F. - -	10
109	183a	MADRAS.	{ End of iron pier.	- -	- -	1	Red.	F. - -	5
			{ Port office.	- -	- -	1	Green.	F. - -	5
140	192	GOPALPUR.	Extremity of pier.	- -	- -	1	Red.	F. - -	3
145	194a	SHORTT ISLAND (highest part).	Dhamra river entrance	20 47	87 4	{ 1 1	White. Red, white, and green. in same lighthouse.	Fl. Fifteen seconds. F. - -	14 - -
173	201	HUGLI RIVER—LONG SAND.	Light-vessel in 22 feet, eastward of sand.	21 35	87 59	1	White.	F. - -	6
196	206	KUTABDIA.	West part of the island.	21 52	91 50	1	White.	F. - -	12
211	208	SAVAGE ISLAND.	Arrakan river entrance.	20 5	92 54	1	See remarks.	- - - -	- -
282	212	CHINA BAKIR,	Edge of flat.	16 17	96 11	1	White with flash.	F. & Fl. One minute.	15
284	212a	RANGOON RIVER. { COLOMBO. { EASTERN GROVE.	Light-vessel at entrance, 2½ miles southward of Grove point.	16 27	96 22	1	White.	F. - -	5
284	213		East side of entrance.	16 30	96 23	1	White.	F. - -	15
259	216a		ANDAMAN ISLANDS—PORT BLAIR.	N. end of Ross island	11 41	92 45	1	White.	F. - -

No.	Colour, or any peculiarity or lighthouse.	Height in feet above high water.	Height in feet of building from base to vane.	Year established or altered.	Character and order of illuminating apparatus.	REMARKS.
183a	- - - -	150	- -	- -	- - -	
186	Granite, two galleries, 12 feet apart.	110	- -	1878	D. 1st Ord.	Shows a flash of 7 seconds duration, eclipsed 8 seconds, flash 7 seconds, eclipsed 38 seconds. Fog bell, sounded twice in quick succession every half minute.
184a	- - - -	150	- -	- -	- - -	<i>Intended to be exhibited early in December 1889.</i>
188	Circular, gray.	104	120	1863	D. 2nd Ord.	The faint light between the flashes is not visible beyond 10 miles.
- -	Flagstaff.	130	- -	1889	- - -	Visible from the bearing of north, through west, to south.
182a	Gray turret.	116	26	1887	D. 4th Ord.	
183a	- - - -	30	- -	1888	- - -	Leading lights, visible seaward from S.W. $\frac{1}{2}$ W. to N. by W. $\frac{1}{2}$ W., and kept in line lead through the centre of the harbour entrance. A red light is shown from end of the wooden pier.
- -	- - - -	60	- -		- - -	
182	- - - -	25	- -	1887	- - -	Will be moved seaward as the pier is extended.
194a	Masonry, red.	76	70	1888	D. 3rd Ord.	Alternate flashes and eclipses, with 15 seconds between the flashes.
- -	- - - -	37	- -	- -	- - -	Narrow red and green sectors, separated by a white ray defining the fairway channel, visible from the westward only.
201	Red, small black ball over large one at main.	21	- -	1853	- - -	Long sand on sides. This vessel is now maintained at her station the whole year.
206	White and red bands, lower story gray.	126	111	1846	C.	Inferior light. From 1st August to 31st December, inclusive, a blue light will be burnt hourly from 7 p.m. to 5 a.m., visible about 20 miles.
- -	- - - -	- -	- -	- -	- - -	Works for increasing the height of this lighthouse were to be commenced in October 1889. During the time occupied in the alterations the present light will be shown from a temporary wooden structure, situated close to and southward of the present lighthouse, and at the same height (99 feet) above high water. As the light when exhibited from the temporary wooden structure will be obscured to the northward by the permanent lighthouse, a fixed white light will be shown from the flagstaff on Fakir point, as a guide to vessels during the night.
212	Screw piles, red, white lantern.	74	- -	1876	D. 1st Ord.	Visible seaward when bearing from N. E. by E. $\frac{1}{2}$ E. S.W. $\frac{1}{2}$ S.
212a	- - - -	54	- -	1887	- - -	
213	Do.	93	105	1869 1881	D. 2nd Ord.	Visible between N.E. by N. and N.W. by N.; a faint light is also seen between N.W. by N. and N.W. by W. Two red lights, vertical, are shown from a boat moored north-eastward of Choki lumps, to mark Torpedo ground.
218a	Flagstaff.	159	- -	1887	- - -	A red light is also shown from end of wooden pier.

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